CERAMICS

JULY
1951

29 Vol. III

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CERAMICS

JULY, 1951

EDITOR

W. F. COXON, M.Sc., Ph.D., F.R.I.C., F.I.M.

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Ceramics

VOL. III JULY, 1951 NO. 29

"EXHIBITION 1951"

YOU folk in the Potteries are a most reactionary lot!

Here is Colin Melbourne, A.R.C.A., in the first fair flush of his experience of the world, setting out to show you "that behind the superficial appearance of nature there is somewhat of a spiritual significance." Oh! How you got excited!

Of course this 4 ft. clay figure was worth a separate unveiling by the Lord Mayor after he had opened the exhibition as a whole. It is even rumoured that this figure, kindly referred to by the operatives at the Wade Group of potteries as "Ivy" is insured for £500. Is it not the ebulition of 3 months' pent up skill and knowledge?

Have we forgotten that a man called Wedgwood in 1790 made a Portland Vase and believe it or not, it was insured for £750 at the recent Wedgwood display! But then of course, it only stood a mere 18 in. or so, and "Festival 1951" stands 4 ft.

The *Evening Sentinel* asks why the figure has been given an outstanding place of honour in the exhibition? But surely the superficial appearance of this contemporaneous product of the pottery art shows a fleeting resemblance to Lord Festival himself! The superficial appearance of nature to Lord Festival at present is far from bright. He has got a job where decisions on fun fairs and South Banks are less important than on Persia and Korea.

Look again at the portrayal of "Festival 1951" in the King's Hall, Stoke-on-Trent. The bemused expression on the face! The outstretched arms! The hopeful stare in its eyes. The mouth about to speak unspoken words. Is not that precisely the political portrayal of Lord Festival himself?

In the Potteries you are confronted with sordid industrial production. Mr. Melbourne having studied at your City School of Art won a scholarship to the Royal School of Art in London where he studied sculpture for 2 years.

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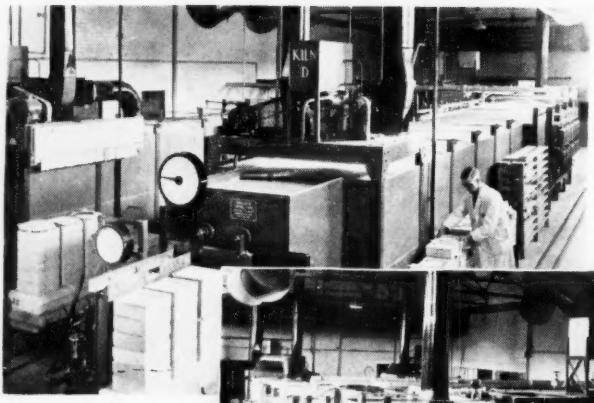

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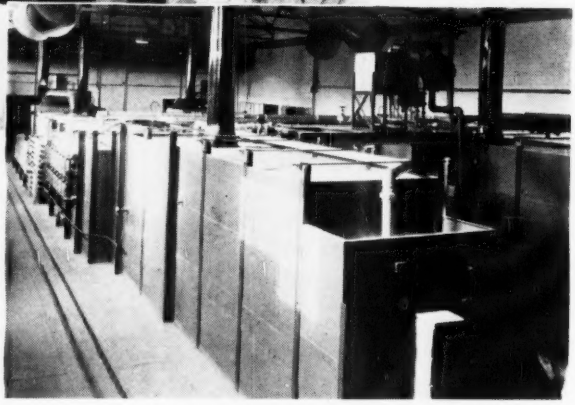

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CAN SCIENCE BE INTERNATIONAL?

by **ARGUS**

IT seems that for centuries we have been plagued by philosophers looking with hopeful eyes to an era of international co-operation in this, that or the other.

Way back in 1601, the Academia die Lincei in Rome, wished to establish scientific non-monastic monasteries in the four quarters of the globe. According to Dr. L. R. Lampitt, in his recent Gold Medal lecture to the Society of Chemical Industry, this project was abandoned some fifty years later.

Now, indeed, some half-a-millenium later, comes U.N.E.S.C.O. or, to give it its correct title, the United Nations' Educational, Scientific and Cultural Organisation.

This is, indeed, an all embracing theme so in the first instance it is as well to get the definitions right!

Mass Production Science

Scientific research today is largely the investigation of "knowns" to produce the "unknown" more quickly than the other fellow. Yet the balancing reason for the investigation is very decidedly commercial or nationalistic.

Compare the way in which Sir Isaac Newton, Roger Bacon or Darwin worked. Then it was mostly a philosophically inspired series of experiments conducted either by a man with his own financial resources as a kind of hobby or else financed by a patron who basked in the reflected glory of the man's discoveries. In either case it was largely a question of personal prestige or, if you like, a sublimination of the ego.

But today that has gone!

Throughout the world various nations mass employ thousands of "scientists" whom are unknowns, and are ever likely to be unknowns, except when once in a while a name is thrown up from the simmering pot, often in an attempt by a large organisation to prove that it is, after all, quite humanistic! The point is that scientists are now employed in the mass and though they are given the name of "scientist," they are no more important as individuals, than the thousand and one factory employees who pour out of the doors of motor-car and other companies, year in and year out.

Rightly or wrongly science has become a seeking after a means to accomplish certain tasks either more quickly or in a manner which will replace an expensive operation by an inexpensive one or, more important still, in order that the armed strength of one nation should be greater than the armed strength of another.

Human Brotherhood

It is obvious then that the expenditure involved becomes an ever-increasing drain on the national resources of each nation. Is it to be expected therefore, that the findings of this new band of scientists are to be made public for the world to see? The trouble is that the social reformer begins with the highly moral axiom of human brotherhood; he assumes that this is a very laudable

ideal though he can perhaps be persuaded to assume that it has not reached a very high peak in human relations.

Yet when it comes to the propounding of his theory or hypothesis, he assumes that the fundamental idea of human brotherhood really exists. Having made this assumption he then proposes his series of reforms. Driven to extremities, he will confess that perhaps human brotherhood is not sufficiently highly developed but points out that spiritually it permeates our whole life and it is only the physical environment which operates against its fulfilment! Rubbish!

But at least scientists if they are worth the name at all, when they set out upon an investigation, must begin with things as near facts as the human mind will yet comprehend.

Unhappy Co-operation

For one reason or another, which matters little, one cannot help but agree that the strongest primeval instinct in the human is self-survival. Martyrs are too few to be classed as other than exceptions and often the martyr burns himself at the stake and simultaneously subliminates his ego to the highest extent.

But the teeming millions are selfish. They may change but as yet they have not!

Out of this mass of selfish individuals is welded a nation, and out of this a national complex producing a world of differing national complexes.

A gain for one means a loss for another! Just as the average family frequently live in unhappy respectability, so do the various nations surrounding the United Nations' table live in unhappy co-operation.

Surely the basic idea of U.N.E.S.C.O. would be that the great scientific discoveries of Britain and America and Russia and China, and so on, would be put at each others disposal. Yet each feel or hope that they have something which the other fellow has not got and jealously guard their supposed secret.

Scientific Closed Shop

Thus the most modern of scientific investigations, namely, atomic energy, although being investigated in every advanced country, is scientifically a closed shop. To a greater or lesser extent this attitude is reflected in practically every investigation which is likely to show commercial or armament strength. Thus, the only things which are published freely are investigations upon such things as the habits, peculiarities and mating qualities of this, that or the other rare species of insect. But even here, the moment someone discovers a selective pest destructor, the publication of knowledge ceases!

U.N.E.S.C.O. is merely set up as a stooge for morality in a world which is more amoral than it has probably ever been. When confronted with sordid comments upon the commercial and nationalistic aspects of science, politicians are able to turn to U.N.E.S.C.O. and say, "but we spent £1,000 or so on this and its object is to defeat this closed nationalistic instinct."

U.N.E.S.C.O. wishes to found international laboratories in various parts of the world. Who is to provide the finance? Who is to supply the personnel? Who is to vet the publication of the results?

Exclude Politics

Obviously if the spirit of U.N.E.S.C.O. is to prevail, politics must be excluded—scientists must represent their scientific discipline or society and not their Government—they must be autonomous and not subject to policy making elsewhere. In this, one cannot help but agree with Dr. Lampitt. Yet since the politicians must vote the finance; since the politicians must largely

agree to the internationalisation of their key scientific personnel; since whenever a group is formed it produces a tendency to grind an axe, these desirable characteristics of an international body of research workers are unrealisable.

Is the country which contributes a million dollars not going to sway the policy of the international body more than the country that pays its humble dollar? Though *pro rata* the tax per head of the population might be higher in the latter than the former?

"I am very optimistic about the potentialities to co-operation in the future," says Dr. Lampitt. Alas, I cannot share his optimism! America is torn betwixt Republican and Democrat; Britain by Labour and Conservative; Russia by an inflexible totalitarian discipline completely subjugating individuality to State worship in its most highly developed form. The other nations tag on behind watching the way the wind blows and hoping to catch the breeze at the right time. As a Swede once said to me, "In World War II it was very difficult for poor Sweden; you see, she had to be neutral on the right side." And so I think we can say good-bye to U.N.E.S.C.O. and its tax free salaries. I doubt if it will last as long as the idea of the Academia die Lincei—some 400 years ago!

RAYMOND VACUUM SEPARATING PLANT

WE have received a leaflet from International Combustion Ltd., 19 Woburn Place, London, W.C.1, dealing with the Raymond vacuum air separator which separates oversize particles from a previously ground aggregate. It will deliver a consistently uniform product from coarse oversize of any fineness to 300 mesh. The plant operation is shown diagrammatically in the accompanying illustration. The rotary motion is imparted to a volume of dust laden air so that a cyclonic action is set up and the dust is reacted upon by the centrifugal force.

Basically the plant consists of a feeder acting as a base with the air separator mounted on top of the feeder. Fines from the separator are drawn through a pipe by an exhaust which blows them into a cyclone collector from which the finished product is discharged. As illustrated the separator consists of two cones with an annular space between them. The material when picked up by the air stream is carried between the cones, entering the inner cone through a series of ports. Pivoted vanes are attached to each port and these can be adjusted to different angular positions.

The following extracts from operating records describe the type of separation which can be undertaken:

Hydrated Lime. The rate of feed to a 3 ft. separating plant is 30 cwt. per hour, the finished product having a fineness of 90 per cent. minus 200 mesh, or 95 per cent. minus 100 mesh B.S.I.

Ebonite. In a moulding factory a 3 ft. separating plant is handling a feed of 3 cwt. per hour, separating at 95·5 per cent. minus 120 mesh B.S.I.

Charcoal. A charcoal producer using a 3 ft. separating plant obtains 6 cwt. per hour separating at 98·5 per cent. minus 150 mesh B.S.I.

Carbonate of Magnesia. A manufacturer is separating to a fineness of 99·9 per cent. minus 100 mesh with a 7 ft. separating plant, the rate of feed being 25 cwt. per hour B.S.I.

Clay (dry). A 3 ft. vacuum separating plant is handling a feed of 12 cwt. per hour of dry clay to a fineness of 99 per cent. minus 40 mesh B.S.I.

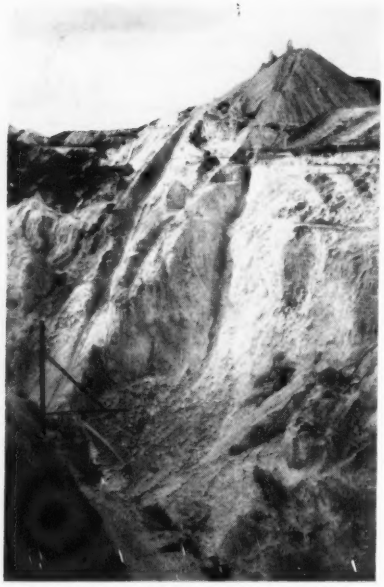
A half pound sample of crude material as it would be fed to the machine, with particulars of output and fineness desired would enable an investigation to be made and a recommendation submitted. Test plant is available at Derby for full scale demonstrations to be made on approved quantities of material without obligation.

Asbestos Cement.—Following increases in costs, the Ministry of Works have authorised Atlas Stone Co. Ltd., to increase current selling prices of asbestos cement building materials by 9 per cent. The increase will apply to all deliveries on and after Monday, 11th June, 1951.

CHINA CLAY—PAST AND PRESENT

(SPECIALLY CONTRIBUTED)

TO the lay mind it is surprising to read that in normal times china clay ranked second to coal in tonnage and value as a raw material export from this country. At the present time, since coal exports have had to be curtailed, it ranks first.



(Courtesy, English Clays, Lovering Pochin and Co. Ltd.)

View of china clay pit showing (in foreground, left) the clay face being washed out and (top) the sand heap (burrow)

William Cookworthy

The china clay industry began in a small way, as far as can be established in 1755 when William Cookworthy discovered china clay in Cornwall. Cookworthy was a native of Kingsbridge, Devon, who subsequently was apprenticed to a London chemist and druggist. Subsequently he became a partner, and a business was established in Plymouth.

In 1736 Cookworthy became a minister of the Society of Friends, but later in 1745 he returned to business with his brother as partner. The latter managed the business in Plymouth, while William travelled for the firm. In his spare time he prospected for minerals. He had read the account of the manufacture of Chinese porcelain by Pére d'Entrecalles, in which the raw materials were described as kaolin and a stone petunse. It is also recorded that in 1745 he was shown samples of china clay and china stone said to originate from Virginia, and also some ware made from them. Cookworthy decided to search for these minerals in Cornwall. Success came in 1755 when he recognised the materials—a white clay associated with a kind of granite—at Tregonnin Hill in the parish of Germo.

After the discovery Cookworthy pursued his experiments into manufacturing porcelain and in 1768 patented (jointly with Lord Camelford) the use of china clay and stone in the manufacture of porcelain and pottery. They sold the patent to Richard Champion of Bristol in 1774.

Opposition of Staffordshire Potters

The latter subsequently applied for an extension of this patent, which was opposed by the Staffordshire potters led by Josiah Wedg-

wood. Subsequently it was agreed that although Champion should have the exclusive use of the materials for transparent ware the Staffordshire potters should be free to use it, for opaque ware and opaque glazes. The original patent was subsequently bought by a group of Staffordshire potters and eventually expired in 1796.

China clay and stone were used in Staffordshire in small quantities as early as 1759.

Rising Production of Clay

By 1855 the output was only about 65,000 tons. Thereafter production began to rise more rapidly, and by 1874 the output had trebled, and by 1900 it had reached over half a million tons annually. By the outbreak of the 1914-18 war the output had risen further to 800,000 tons a year.

Between the two world wars the yearly output fluctuated between about half a million tons to just over 800,000 tons, the highest figure being 869,232 tons in 1927. The second world war led to a severe decline in production since exports had to be curtailed but it has risen steadily since, and the demand is now such that the material is in short supply, and more labour is urgently needed in the pits.

Users of China Clay

To the ceramist it is perhaps surprising to learn that potters are not the biggest users of china clay in this country. It was estimated in 1946 that the paper industry would require about 130,000 tons and pottery only half that, while other users included the paint industry, 14,000 tons, refractories and electrical porcelain 7,000 tons. The total estimated home requirements were 242,000 tons in 1946. Other uses of china clay include textiles, insecticides, cement, chemicals, medical, leather and cosmetic manufacturers.

The North American market is the largest single customer for British china clays, where they are in demand for pottery and paper manufacture.

Location of China Clay Deposits

The only deposits of china clay in Great Britain which are of economic importance are located in the granite areas of Devon and Cornwall and principally in St. Austell, Bodmin Moor and Dartmoor areas. These are well suited for the exploitation of the material as the deposits occur on high ground, thus facilitating the piping of the clay-water slurry to the coast where water transport is available for the export trade.

In former times much of the clay was sent to other parts of the country by sea and canal, but the sharp rise in coastwise freight charges has now diverted much of the clay traffic to road and rail.

Formation of the Clay

The deposits of china clay in this country are what are called primary deposits, i.e. they occur in contact with the hard granite, from which they have been formed, by a process called kaolinisation. In other parts of the world, notably in parts of N. America, the deposits have been laid down after being transported by water. These are referred to as secondary kaolins, and they differ in properties from the British primary clays.

Kaolinisation can occur in two main ways, by the action of natural weathering agents, and by the action of hot gases and liquids rising up from the depths of earth. In the first case weathering may arise from the action of water and atmospheric carbon dioxide acting on the felspar in the rock:

e.g. $K_2O\ Al_2O_3\ 6SiO_2 + 2H_2O + CO_2$
(felspar)

$= Al_2O_3\ 2SiO_2\ 2H_2O + 4SiO_2 + K_2CO_3$
(china clay) (silica) (pot. carb.)

The potassium carbonate is leached away and the silica is also

(Courtesy, English Clays, Lovering Pochin and Co. Ltd.)

View of clay face showing hoses washing out the clay, leaving debris

removed as a colloidal solution of silica. Such a theory does not account for the huge deposits found at great depths, and it is concluded that the decomposition of felspar to kaolin has occurred in these cases by the action of hot gases and liquids, possibly during the time when the molten granite was cooling. Possibly the action may have been due to superheated steam helped by gaseous boron and fluorine compounds:

$$\underset{\text{felspar}}{\text{e.g. } K_2O\ Al_2O_3\ 6SiO_2} \rightarrow$$

$$\underset{\text{china clay}}{Al_2O_3\ 2SiO_2\ 2H_2O} + 2KOH + \underset{\text{silica}}{4SiO_2}$$

Reserves of Clay

The depth of the main deposits of china clay is not known with certainty. In the deepest pits, now worked at over 300 feet in depth, the kaolinisation is as intense as it was at lesser depths. Experts have stated that the known deposits in Devon and Cornwall are likely to last for a century if exploited at the rate of a million tons annually.

China clay is produced in this country exclusively from open pits. The largest has a surface area of over 50 acres and the deepest in 1946 was 360 ft. Average figures given for china clay pits are 8-10 acres in extent and 150-200 ft. deep.

The overburden consists of soil, partially weathered granite and discoloured clay ("growan") and is of variable depth. This was formerly removed by hand, but is now cleared by mechanical excavators and dumpers, or in the case of shallow deposits by bulldozers and scrapers.

The Cornish Pump

Since the essential feature of extracting china clay is to wash it out from the associated rock, it is obvious that a good water supply and a pumping system are essential.

In the earlier days of the industry pumping was done by steam engines. Before opening up a pit a shaft was sunk to a suitable depth and a level or drift was driven across towards the pit site. From the end of the drift a shaft was cut

upwards to the surface. This was called the "rise" or "washing shaft" and a button hole launder in wood was fixed in it. Through this launder the china clay was washed in suspension to the drift from whence it was pumped to the surface. As the pit deepened the launder was cut down. When the pit had reached the depth of the horizontal drift it was widened out laterally, the clay slurry running right into the horizontal drift. A channel is usually dug around the top of the pit to prevent discoloured clay being washed into it. This shaft limited the depth to which the clay could be extracted and involved a heavy capital expenditure. Moreover as veins and islands of undecomposed rock occur with the clay it was sometimes difficult to extract some areas of the pit because of the difficulty of washing the slurry to the central launder.

Introduction of Centrifugal Pump

About 30 years ago the centrifugal pump was introduced as an alternative to the Cornish pump. This gave greater flexibility in extracting the clay as well as doing away with the heavy capital expenditure required in erecting a pumping station.

The face is washed down with powerful jets of water from a monitor fed by steel piping. More than one of these can be used at a time, and four or five are used in large pits.

Sand Pits

Before being pumped to the surface the coarser impurities in the clay slurry, such as sand and particles of rock are allowed to settle in a sand pit situated somewhere near the bottom of the clay pit. These are rectangular troughs approx. 60 ft. by 12 ft. with stone walls 3-4 ft. high erected in pairs, so that one can be emptied while the other is in use. When the sand pit is full it is discharged into wagons run under it and then elevated out of the pit by self tipping skips. For every ton of clay obtained about five tons of

(Courtesy, English Clays, Lovering Pochin and Co. Ltd.)

A close-up, showing the washing out of the clay

waste materials have to be disposed of.

The mounds of sand (burrows) form conspicuous landmarks in the china clay areas, and one of the largest is estimated to contain over a million tons of material. Unfortunately some of these dumps cover deposits of china clay.

Use of Sand for Concrete Houses

This sand is used for making concrete blocks for house construction, and houses built in this way half a century ago are in good condition. A post-war development is the erection of factories to manufacture concrete castings for the Cornish Unit House, many of which have been erected in the south-west of England. An extension of the use of clay-pit sand for this purpose seems likely.

After the sand pits the clay slurry may pass over shallow channels called drags to further remove impurities and then containing about 2-3 oz. of solid per gallon is pumped to the surface by centrifugal pumps and delivered to the circle head of the "mica drags." This is a semi-circular pit about 30 in. in diameter and 2-3 ft. deep where some settling may occur.

The Mica Drags

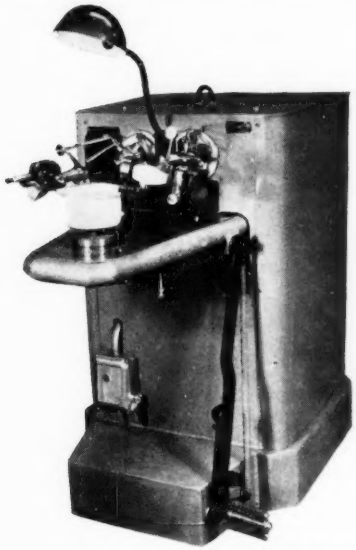
From thence the slurry runs to the mica drags. These are long shallow troughs built of concrete and may be 150 ft. or more long by about 30 ft. wide. These are further subdivided into channels about 20 in. wide with hinged baffles about every 25 ft. As the channel fills up the baffles can be raised. When the mica, etc., in any section, has accumulated sufficiently it is removed by taking out a plug and pushing the debris through the hole with a "shiver." The debris is often run to waste. It is important to remove the mica as this acts as a flux in firing.

Settling Pits

After the "micas" the slurry, containing about 2 per cent. solids, is run to the settling pits. These are

(Courtesy, English Clays, Lovering Pochin and Co. Ltd.)

View of mica drags and settling pits with drying kiln and linhay in background



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rectangular or circular. In modern versions these may be 20-40 ft. in diameter, 15-20 ft. deep, but cone-shaped for about 4-5 ft. from the bottom. The sides are made smooth with concrete and a plug is located at the apex of the cone. Here the clay is allowed to settle to a creamy consistency containing about 10-12 per cent. of solids. As the clay settles the clear water above can be run off by withdrawing pegs in the sides of the tank and it may be used again if required in the pit.

Research is constantly going on to speed up the settling of the clay. The settling pit is emptied by removing the plug and the slurry is piped to the clay dispatch point. This often involves a journey under gravity of many miles; the longest being about 10 miles.

Final Drying of Clay

At the dispatch point the clay is finally dried. Formerly this was done exclusively by allowing it to settle in large stone or concrete tanks, some holding up to 1,000 tons of wet clay. These are fitted with boards and plugs in one side for tapping off water and the clay is allowed to settle for 6-8 weeks until it becomes a buttery solid with about 55-65 per cent. of moisture.

These tanks and the attendant dryer are situated conveniently to a railway or wharf.

Use of Filter Presses

In recent years the tendency has been to dewater clay from the settling tanks in filter presses, which are either operated by natural head of pressure or with a slip pump. The modern filter press can be operated with very little effort on the part of the operative and it delivers a clay with only 30-35 per cent. of water. Drying press cakes takes only about half the fuel required for drying "tank" clay. As an offset to this it

requires rather more labour to dry clay by filter presses but this is more congenial. Emptying a clay tank on to the drying pan is a heavy and dirty job, and in these days of labour scarcity this fact has to be considered in recruiting personnel. Since filter press clay can be dried more rapidly, as it contains less water, the output potential of the drying stoves is considerably increased.

The use of filter presses has been steadily increasing in recent years and the present price and scarcity of fuel in the West of England encourages experiments with other types of apparatus to make drying a less expensive business. Experiments with rotary kilns are pointers to possible future developments.

The Drying Kiln

The drying kiln used is a large concrete structure heated by flues running under the floor. It is commonly 250-300 ft. long, 40-50 ft. wide, and about 18 in. deep. The floor of the kiln is made of porous fireclay tiles about 18 in. × 12 in. which are approximately 8 in. thick at the fire end and 2 in. at the stack end. This is to prevent the clay being over heated at the hot end of the floor.

Such a kiln would dry about 200-300 tons of clay a week. The pans required emptying at the fire end daily while at the cooler parts it may only be emptied two or three times a week. To facilitate drying and emptying, the clay when solid enough is scored across into squares by a cutter. It is located alongside the settling tanks or the filter presses.

Such a kiln represents a major item of capital expenditure, and it is understandable therefore that the advantages of any alternative system of drying would have to be substantial before any rapid change over could be expected.

From the dryer the clay is shovelled into the stove or "linhay," the floor of which is usually below the level of the dryer fan to facilitate loading. The shortage of labour has encouraged the use of mechanical equipment to replace men with shovels for unloading the pans into the linhay, and their use is likely to increase. A linhay should hold at least 1,000 tons of dry clay.

Research in the Industry

Needless to say mechanisation of production is more easily achieved in large units and the present tendency is for fewer and larger pits to be operated. The amalgamations which have taken place in recent times now mean that the bulk of the production of British china clay is done by one large company. This has equipped its own research laboratories in which work goes on continuously to improve the quality of the material required for the various industries and to find new uses for china clay.

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ALUMINIUM BODIES FOR TIPPING VEHICLES

UNDER the above title we have received from the Northern Aluminium Co. Ltd., Banbury, Oxford, a booklet describing the use of aluminium bodies for large tipping vehicles, being an attempt by the Development Division to consider the varied uses of aluminium.

It is pointed out that seldom can the merits be formulated strictly in terms of cash but by co-operating with manufacturers of chassis and bodies, it has enabled a fairly accurate comparison to be made of respective costs for vehicle mounting on an aluminium body against the same vehicle with a wood and steel body. Although, as yet, the life of the aluminium body or its maintenance costs are not known accurately, it is hoped that the life will be longer than usual and maintenance costs lower.

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COKE OVEN CERAMICS

A PAPER entitled "Progress Review No. 13—Coal Carbonization—Coke-Oven Practice," by D. T. Barritt, B.Sc., M.I.Chem.E. and T. Kennaway, B.Sc., A.R.I.C., of Simon Carves Ltd. (*J. Inst. Fuel.* 23, 134. 308/312) says:

Examination of the history of by-product coking shows that fundamental changes in design and method have been few, and in this respect recent years have shown no exception. Major changes, comparable with the adoption of the regenerative principle or the use of silica refractories, have not occurred and the trend has been to retain the broad features of existing pre-war designs and to introduce refinements with the object of attaining greater efficiency, cleaner conditions of working and reduced physical effort.

War-time irregular operation has disclosed defects in design which would, under normal conditions of working, have appeared either much later or not at all. Panels of experts drawn from all branches of the industry have studied such matters, under the aegis of the British Coke Research Association, and have issued recommendations which are now being adopted with advantage in current designs. Much thought has also been given by the same body to the best methods of plant operation and a number of informative bulletins[1] have been issued on this subject. There has been an increased awareness of the necessity for comprehensive instrumentation on the modern coking plant and of the need for the intelligent interpretation of the results obtained.

Oven dimensions are tending to become standardised; the height of ovens now built rarely exceeds 13 ft. although the British Coke Research Association analysis, referred to above, clearly shows that height of oven chamber does not affect the life of the plant. Oven widths of 18 in. are still the most common for blast-furnace coke plants, and the length of ovens has not increased beyond 45 ft., which appears to be the maximum figure for all designs.

Almost all ovens now built are of the Underjet type, in which the brickwork is built on a concrete substructure containing the rich gas distribution pipes and jets. Plants are now being constructed, however, with an extension of the Underjet system to permit a similar subdivision of lean gas and air in metal pipes embedded in the substructure decking. It is considered that this system will result in more accurate control of the heating and should lead to improved economy. The results, however, are still awaited.

Shortage of Silica

In France the shortage of silica has given impetus to a new development in wall structure.[2] In this oven only the oven sole and walls are built of silica, and semi-silica is used below sole level. The difference in the expansion between the walls and the portion below sole level has been dealt with in a novel manner. In the battery described this has been done by building up the wall in twelve vertical panels each aproximately 1 metre in width and constituting one complete twin flue. The expansion space between successive panels is made uniform, and is so calculated that, when the oven structure is heated up, each pillar expands to meet its neighbour exactly, and the ends of the wall and the under-sole portion coincide. This is known as a free-expansion wall. It is claimed that any small leaks between adjacent chambers in such a battery, i.e. leaks between the panels, are quickly sealed with carbon when the oven is in operation. In addition to the saving of silica, the main advantages claimed for this new design are that it minimises leakage both above and below sole level and that such ovens can be cooled down and reheated successfully.

A New Method

Another interesting development[3] which involves a new method of operation as well as the necessary modifications to the oven brickwork arose at Kiel from the need for increased gas output. This problem was solved by dilution with producer gas and by steaming the hot coke in the chamber. Dilution with producer gas is not unusual, but the method of steaming the charge is worth summarising here. The steam is generated at a dry quenching plant and is then passed through superheating coils in the end walls of the battery. A considerable degree of preheating is necessary to avoid damage to the refractories and to ensure good decomposition of the steam. From the superheating coils the steam, now at a temperature of about 400° C. and a pressure of 2·5 to 3 in. w.g., is introduced into two channels formed in the brickwork below each oven sole. From these channels and at about 1 metre intervals, branches rise vertically in the oven walls with jets into the oven chambers at heights of approximately 8 in. and 14 in. above the oven sole, and to prevent the jets becoming blocked with coal they are inclined downwards.

No "Scurf" Formation

The introduction of the steam at the base of the charge gives the steam a longer distance to travel over the coke, thereby improving the composition of the gas. Steaming was prolonged for periods up to 12 hr. without damage to the refractories—in fact, it has one advantage in that it prevented

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the formation of "scurf" on the chamber walls. This process was operated successfully for more than 3 years during World War II.

Oven Units

There is an increasing tendency to build ovens in small independent blocks between permanent buttresses, so that each block can be taken out for repairs or complete renewal without disturbing the neighbouring ovens. Where such a block of ovens is to be rebuilt and lies between the coal service bunker and a working battery, it is customary to bridge the gap to carry the charging car, which is designed initially to suit. It is recognised that to divide a battery in this way is costly and results in increased gas consumption; nevertheless, these disadvantages are considered to be outweighed by ease of repair.

Local circumstances such as gas or coke contracts affect the subdivision, but eight ovens per block are not uncommon and in one case (a gasworks) the number is as low as five.

Refractories

No new refractory material for coke ovens has been used of recent years but the employment of refractory concrete for waste-heat flues, oven door-linings and battery top-paving is an indication that a refractory, which can be cast in situ, is coming into prominence for the low- and medium-temperature parts of the structure.

Hammer-head bricks, or a modification thereof, to provide greater wall strength are being increasingly used by coke-oven designers and a saddle-brick design for the wall stretchers, in which the bricks are interlocked in the horizontal plane, has been produced from America, but is probably unlikely to be a permanent feature.

Ovens are still being built both entirely in silica and of a design in which the regions subject to high temperature are constructed in silica and the remainder in fire clay. The two types appear to be equally successful.

Brick designers have now to take into account the practice of machine moulding. By agreement among contractors and brickmakers certain features of coke-oven shapes, such as the dimensions of rolls and grooves, the radii of the corners, and maximum size of the shape, have been standardised in an attempt to speed up manufacture.

Insulating material is being more extensively used below the oven tops, beyond the door linings and for the regenerator facings, and in one or two cases the oven tops have been paved with large refractory concrete slabs.

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Correspondence

INFORMATION WANTED

DEAR SIRS,

We are seeking information concerning the machining of ceramic materials, and we wondered whether you could refer us to any published information which may assist us?

The turning of ceramics in the "rubber hard" condition is of particular interest to us and we require details of cutting speeds, feeds, type of tool used and tool angles. Any information concerning other machining processes, such as grinding would also be of value.

We would be grateful for any assistance that you may be able to afford us, regarding published information, or in the event of you not being able to help us in this respect, perhaps you could suggest further organisations of firms that we could contact.

Yours, etc.

BRITISH POTTERY MANAGERS' & OFFICIALS' ASSOCIATION

So you want to be a Manager?

by **I. R. FORSE**

(W. T. Copeland & Sons Ltd.)

A GOOD pottery operative performs a given job as quickly and as skilfully as is possible. A good director formulates a policy and controls his organisation so that his policy is translated into fact. A good manager employs his abilities to ensure that the policy does become fact in all its details, in so far as it comes within his jurisdiction.

Works Organisation

Briefly, a works organisation consists of the following essential parts:

Firstly, the operatives who actually do the job; then the foreman who sees that the individual jobs get done; then the departmental managers who organise for the efficient performance of the jobs and who weld the individuals into a localised team, and who carry on liaison with their fellow members of the staff. Following these are the managers whose duties are more general, works managers and so on, who must see that all the efforts made blend together. They must view the field of production as a whole, and acting with a wider outlook, must plan and think, as much as do, making sure that individual efforts are not wasted. They take guidance and instructions from their directors, and translate their wishes into action.

Finally, the directors formulate a policy and vary it as occasion demands. They are the focal point from which should spring the inspiration and guidance, practical or otherwise, which is needed by the managers and operatives.

Works management in the pottery industry calls for technical knowledge, practical knowledge, organising ability, skill in the handling of labour, and above all, a deep interest and enthusiasm for the whole business of potting.

A Good Foundation

Technical knowledge can be obtained by attending the North Staffs Technical College for instruction, and a man who has passed Advanced and Honours courses and obtained his Pottery Manager's Certificate, has a good foundation upon which to build a manager's career.

The possession of certificates does not make their possessor a good manager; he must learn the hard way by experience in the factory, and he must always keep his knowledge up to date.

The potential manager should read everything he can lay his hands on about the ceramic industry; he should take every opportunity of discussion with more experienced men, and must always realise that from the humblest mould-runner upwards, most operatives have something to teach him. He must observe the behaviour of men and of materials, and he must think about what he has observed. He must accept nothing at its face value, but must always find out why each phenomena occurs, why each operation is performed, why one operative produces better work than another.

Paper presented to The Stoke and Hanley Branch, 21st May, 1951.

In fact, it must be "Why?" "Why?" "Why?" all day long.

Practical knowledge is only gained by factory experience. There is no short cut. Your own and other people's mistakes can teach you much. If you are employed in a particular section of the works, take every chance you get of finding out what goes on in the other sections, and a young manager particularly, should try to organise a periodic move to a new section so that his field of experience is widened.

Importance of Figures

Factory figures, such as oven results, are of much importance to a manager provided that they are correctly interpreted. Learn to use all available figures and be on the look-out for recurring patterns which can often give clues to faults, e.g., it may be noted that a run of high readings of Bullers rings from the biscuit oven is followed by a run of high percentages for spit-out. Check back over a period and see if this has occurred before, and if it has, then that particular form of spit-out would appear to be connected with the biscuit fire and this should be the first field in which to apply detective work. The tracking of faults and the curing of faults form an important section of most pottery managers' work, and factory figures can provide many clues.

These figures can also be of use as a guide to the economical working of any and each department, and each departmental manager should know what his wage bill amounts to and should balance this against the dozens of ware dealt with, and should also keep a check on the loss and on the cost of recovering faults.

The whole picture can only be seen when departmental production figures and the cost of loss and recovery of faults are balanced against the total value of packing over a period, and it should be pointed out that actual figures viewed alone, can mislead, and that only percentages can give an idea of the true situation.

One should guard against making a fetish of figures, but they can be and should be an essential tool for the use of a manager, and can, in fact, save him many hours of fruitless work. If the figures help to produce better pots and more economical running—use them; If not —scrap them!

As far as figures relating to faults are concerned, it often pays, where excessive loss occurs, to break down still further the normal figure, i.e., should the glost grinding percentage increase abnormally, break down the grinding figure into percentages of oven dirt, dirty colour, glaze faults, lugged, etc., and you will see at once where to concentrate your attentions in order to reduce the overall figure to normal.

Labour Problems

Under present conditions the handling of the workpeople is one of the trickiest parts of a manager's job. He is normally more closely in touch with them and understands their outlook much more than the board of directors, and in dealing with any problem, a policy of scrupulous fairness will pay dividends. In fact, it is the only policy which will work. Not only must he be fair, but the workpeople must be made to feel that he *is* fair. Pottery people are notoriously blunt, and the direct approach with an honest appeal to their sense of fair play will in many cases save much bad feeling. Rambling explanations designed to kid the workpeople, appeals to loyalty, exhortations to work harder, are of no use unless they feel that they can rely on the firm to give them a fair "do," and the onus is on the management to ensure that this is so. It should also be noted that it is part of a manager's duties to see that his directors appreciate the workers' side of any case, and he must anticipate as far as possible the reactions

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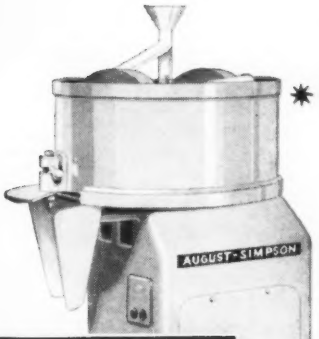

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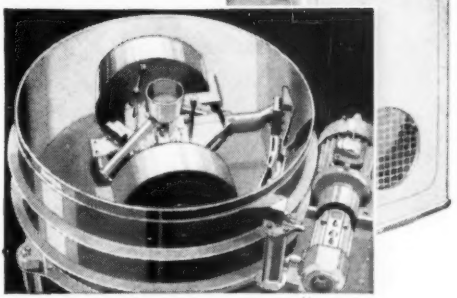

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of the workpeople to any proposed move, and he must place this information before his superiors during discussions.

In all spheres of management, from the highest to the lowest, it is essential to avoid getting a reputation of being weak; in the handling of labour a manager must be friendly, but he must also have a strong hand even if he does not always show it. The whole art, of course, is to show it only when the situation requires it to be shown.

It is essential to maintain good relations with the operatives and the following points all help towards this end. Always tell people how they are doing whether it is well or badly, and if it is badly point out how he can improve. Make a point of looking for good work as well as bad, and give credit for it—encouragement goes a long way and people like to have their skill or effort acknowledged.

Making Changes

Never make changes which effect operatives until you have first told them what you propose to do and why you are going to do it. Very much trouble is saved if you can get them to accept a change before it is made and active co-operation is more likely if those concerned feel that they are being treated as responsible members of the firm and not just being pushed around at a manager's whim.

Each operative should be used to the full extent of his ability and if he has more ability then his job calls for, then make sure that he is marked for promotion. It is only natural that those who are above average and take the trouble to improve at their job should also expect to be noticed and considered for promotion. A manager should first look round his own workpeople when a vacancy occurs for the better type of job and not automatically assume that he can only fill the post from outside sources.

"A prophet is not without honour save in his own country" too often applies where promotion is concerned.

Attitude to Company

There are two pitfalls which a young manager must avoid. One is that of becoming a "little Hitler"—the "I'm the boss and to Hell with all of you" sort of attitude, and the other that of courting popularity with his workpeople by being "one of the boys."

It is invariably the case that a good manager is loyal to his firm. Promotion can be missed because of lack of loyalty, and to be gained by its existence tipping the scales. A man who indiscriminately runs his own firm down to others, erects of his own choosing, a barrier to promotion. Apart from the practical fact, not always appreciated, that much of what is said and what happens in a factory, finds its way by devious channels into the boardroom, this attitude acts as a psychological brake on one's efforts.

The day of the "Yes-man" is nearly over in this industry, and if your job requires you to be a "Yes-man" then get yourself another job as quickly as possible, for that state of affairs carries no satisfaction. The judicious use of a little soft soap now and then is merited as occasion demands, but it is always better to say "No" when that appears to you to be the best answer remembering that a soft "no" may "turn away wrath" and accomplish as much or more than a loud and strident "No."

The whole thing can be summed up by saying that a manager must be tactful as well as honest when dealing with his superiors.

Mistakes

Even the best manager makes mistakes, and, as has already been pointed out, they are one way of learning. A mistake should teach you what not to do, and thus

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point out the more positive line of what to do in order to avoid the same trouble again. Above all, where a mistake does occur, and it is of important dimensions, do not panic and try to hide it, but be honest and put the facts to your senior manager or to your directors; they are quite human and; have probably made worse mistakes themselves, and in any case you will get into much hotter water if it all comes out eventually and it becomes obvious that you have been covering it up. It is not a bad plan at times to carry it into the other camp and say "Please I've made a mistake—will you help me to put it right?" This is often a good move both from the practical and from the psychological angle too, providing it does not happen too often.

Disputes

A manager is often involved in disputes over wage rates, piece-work prices, conditions of working and numerous other grievances. It is always a good plan to obtain all the facts, figures and information on the subject, and to quietly study these before entering into any discussion with the people concerned. It is not always possible to know all the facts about every section under your jurisdiction at a minute's notice, but you can usually find time to refresh your memory as occasion demands, and thus go into the fray with the advantage of being fore-armed.

When a whole department is involved in a dispute, it is usually better to ask for a limited number of spokesmen, rather than to have dozens of people all trying to talk at once. Moreover, tempers are like spontaneous combustion, they are more likely to become dangerous when a large number of people with a grievance are massed together. It is only stating the obvious to remark that whatever happens, you must keep *your* temper in all circumstances.

The whole question of how to handle a problem is very neatly summed up in the suggestions given by the "Training within Industry" people who say that the approach to a problem should be as follows:

1. Get all the facts and analyse the problem.
2. Weigh and decide being careful not to jump to conclusions.
3. Take action.
4. Check results.

This framework fits all problems and it should be noted that the checking of the results of any action taken is an important part of the procedure. Not only does this checking make sure that the immediate problem is in fact solved but it also provides information as to the effect—positive or negative—of a given line of action and should give guidance as to any future action to be taken when other troubles arise.

Use Research Facilities

Works and departmental managers' sometimes tend to underestimate the value of Works' Research Departments and of the British Ceramic Research Association. It is a wise manager who uses to the full the research facilities at his disposal.

Research workers have no magic wand to wave to provide an instantaneous cure for faults, but they have much information available on most subjects, and apart from saving you the task of covering ground they have already covered, they can often give pointers, which, together with your more intimate and practical knowledge, lead to the required solution of the trouble.

The British Ceramic Research Association are always ready to help, so let them earn their keep and provide the help they are paid to give—but they cannot help you unless you first tell them of your troubles.

Development is closely tied up with research and with management. The development of plant, machinery, materials and processes should always occupy the mind of a manager. A man who believes that there is no scope for development in his department is either very lucky or else, and this is more likely, he is not a good manager. Many ideas for improvements come from the operatives, and should all be investigated.

Many half-formed and imperfect suggestions from even the humblest of workpeople may contain sufficient of a germ to enable an improvement to be effected.

Planning

Thinking ahead is, in some ways, one of the bugbears of a manager's life. The tendency is to leave the thinking and planning till "tomorrow"—because "there is so much to attend to today."

The visible results of thinking ahead or planning are often a long while in becoming apparent, and this time lag tends to make this a neglected part of a manager's job. The higher up the managerial scale you rise, the more important does this thinking ahead become, and the habit should be cultivated from the earliest days of any manager's working life. Even if there appears to be no chance of carrying out alterations, structural or otherwise, at the moment, it is a good plan to have noted the possibilities of your section of the works as far as improvements of layouts and plant go, and to see that any alterations which do occur fit into the ideal scheme as nearly as possible.

To attempt to alter and improve odd bits here and there can result in the finished position being worse than the original, unless it is worked into the planned key ideal.

Any alterations made should fit into at least one of the following categories:

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2. The amount of labour required.
3. The number of operations performed to complete a given job.
4. The quantity of ware dealt with in a given time.
5. Working conditions.
6. Flow of production.

Just as a departmental manager is in a bad position if his workpeople are unsatisfactory, so are senior executives largely dependent upon their junior managers, and a wise manager never, if he has any choice, engages juniors carelessly. It is the old business of a chain being as strong as its weakest link. Juniors should always be encouraged and their opinions listened to, and senior managers should make a point of training managers in junior positions and not just let them drift along with a minimum of guidance. If a man resents being taught, then he will probably not make a good manager. It is sometimes not realised by younger managers that they should be a good investment to their directors, who like to show a profit. They should always do a little more work than they are paid for and thus be a bargain and a source of satisfaction, and if they do 5 per cent. more work when they earn £5 a week and keep the 5 per cent. up as they progress, they will be quite a bargain at £1,000 a year.

Visit Other Factories

While it is often difficult or impossible for a manager to leave his work, yet the time spent in visits to other factories is well spent. A wide outlook and a comprehensive knowledge of the industry are a great help to anyone holding a position of authority. It is always stimulating to see what the other fellow is doing, and it is often possible to get ideas from other industries. Even the method of approach to a problem in a completely different type of industry can provide

the key to one of your own problems.

Apart from the chance of practical assistance gained from such visits, the widening of the outlook which must result, though not always apparent, is of great aid to any manager, who surely needs such an outlook, dealing as he does with a wide variety of people and of situations.

Share Your Worries

There is an old tale which says "Do what you are told; work 8 hours a day and don't worry—and then eventually you may become the boss, work 12 hours a day and have *all* the damned worry!" and there is a certain amount of truth in it. Certainly all managers have their share of worry—that is part of their job—BUT once the worry becomes great enough to affect the mental outlook, then judgment and sense of proportion are impaired, and while it is wasting time to say "Don't worry" (some people just cannot help it) there is a way out. Push some of the worry off on to your immediate superior—that's what he is there for! The art of keeping calm when others panic is something which can be cultivated—hard as it may seem—and not panicking is half the battle when trouble arises on a factory.

No Blueprint for Success

Each factory differs from the next and has its own peculiarities, and no two managers' jobs are alike. There is no blueprint to success, but all managers have one thing in common; upon them depends to a very large degree, the future of this industry. They must hold the balance between employers and operatives; they must seek and press for improvements; they must develop new methods, interpret new laws and regulations; they must train men, advise directors and operatives, be amateur psychiatrists and whipping boys; they must be kind, ruthless and benevolent; technical experts, mechanics and organisers; they must spend money, save money and make money for their firm; they are, in fact, the Poobahs of potting.

An Individualist

Finally, no manager should be content to bleat in unison with others that he wants more money, better conditions, or improved status. While much can be done by collective bargaining, and while it has its place in the scheme of things, yet any manager worthy of the name should be an individualist, and should be prepared to fight his own battles and to stand on his own feet. The very nature of his job trains him and shapes him into being an individualist, and he should be proud of this and not entirely sink his identity and his views in the single voice of an association. He should be a member of the Pottery Managers' and Officials' Association, but should use its strength to give benefit and guidance and help to the industry in general, and not regard it mainly as a lever to be used for his own benefit, even though it is right and proper that the association should be used for the benefit of both managers and manufacturers.

WILCO-WIGGIN THERMO-METAL

THIS booklet was first published in 1947 and has recently been reprinted and published by Henry Wiggin and Co. Ltd., Wiggin Street, Birmingham 16.

The temperature-sensitive bimetals, or "Thermometals," produced by The H. A. Wilson Co., Newark, U.S.A., have a reputation for uniformity of properties and reliability in performance. The association of Henry Wiggin and Co. with The H. A. Wilson Co., began in 1937, when Wilco-Wiggin Thermometals were first made available in Great Britain and Europe.

The publication gives the engineer designing thermostatic devices information on the properties of Wilco-Wiggin Thermometals, to help him choose the best grade and size for any particular application.

J.D.
THERE ARE NO BETTER COLOURS
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British Pottery Manufacturers' Exhibition

THE Pottery Exhibition in the King's Hall, Stoke-on-Trent, organised by the British Pottery Manufacturers' Federation, together with the North Staffs. Industries Fair, held on the old Port Vale ground, Hanley, sponsored by the North Staffs. Chamber of Commerce, were officially opened on 9th June by the Lord Mayor of Stoke-on-Trent, Alderman J. Barks, J.P. The joint event gave an opportunity for North Staffordshire to show the important contributions the area makes to the trade of the country.

King's Hall, Stoke-on-Trent

Here, at the only exhibition in the country devoted entirely to the Ceramic industry, no fewer than 38 of the leading manufacturers of domestic china and earthenware, showed their products on well-designed stands, while not the least interesting feature of a wonderful show was the display of English pottery from Roman times to A.D. 1900, arranged by the Stoke-on-Trent City Museum.

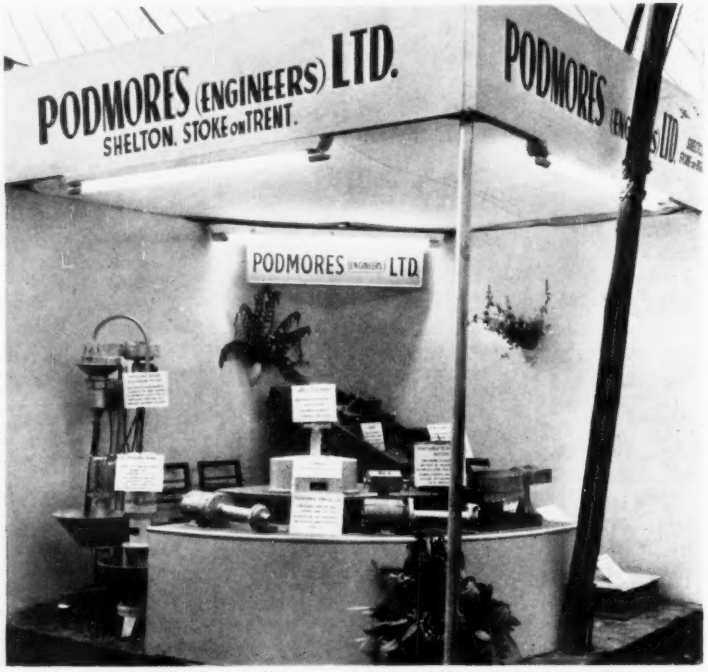
The British Ceramic Research Association had two stands on which pottery manufacturing processes were easily to be followed by reference to photographs, models and diagrams.

Those sections of the industry producing glazed tiles and sanitary ware were represented by a striking show of their goods in interesting group displays.

The Electrical and Technical Porcelain section, whose products are so vital to the electrical, chemical and

other industries, exhibited components ranging from pinhead size to pieces as tall as a man, proving in no small degree how well the ancient craftsmanship of the potter has been married to the exacting requirements of scientist and engineer.

No mention of the exhibition in King's Hall would be complete without reference to the much discussed symbolic figure "Festival 1951." A centre of attraction and subject of much comment, the figure was designed by Colin Melbourne, A.R.C.A. of G. Wade and Son Ltd. A fine technical achievement, the figure was produced by the Wade group of potteries.



The stand of Podmores (Engineers) Ltd., of Shelton, Stoke-on-Trent

North Staffordshire Industries Fair

Here were over 200 stands on which were displayed many outstanding features of the various products of North Staffordshire. Among those stands showing items of interest to the Pottery and Allied Industries were the following:

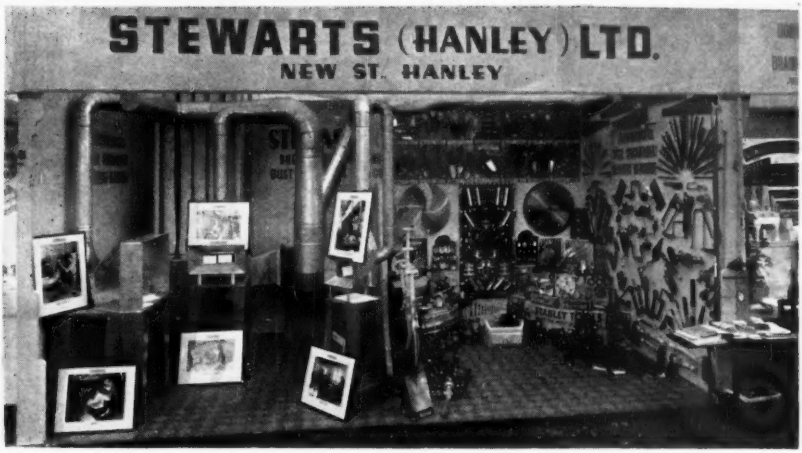
Dart Cash Carrier Co. Ltd., Campbell Road, Stoke-on-Trent. Specialists in the manufacture and installation of large industrial vacuum cleaning plants designed particularly for the efficient and economical cleaning of factories where considerable quantities of clay dust have to be removed without raising any dust to atmosphere.

Francis W. Harris and Co. Ltd., Moorland Road, Burslem. This company has over fifty years' experience behind its organisation, and offers excellent service backed by large stocks of factory, mine and electrical equipment.

The electrical department has been dealing with industrial installations and maintenance for over thirty years, and forms an important part of the company's activities.

The power-operated tile cutting and grinding machines, complete with dust collectors, were of interest to the tile trade.

Hartleys (Stoke-on-Trent) Ltd., Shelton Old Road, Stoke-on-Trent. This firm of general engineers are specialists in



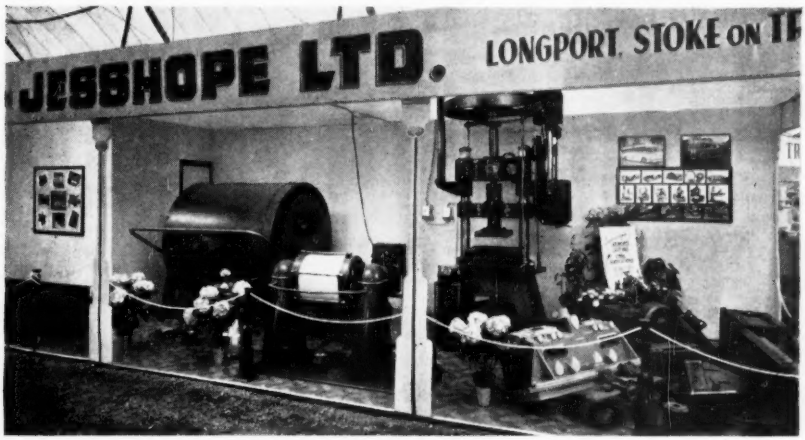
The stand of Stewarts (Hanley) Ltd., at the North Staffordshire Industries Fair

equipment for the purification of sewage and trade waste.

Of special interest to the Pottery Industry is the Hartley patent sizing machine for sizing paper prior to printing, and the "Spiro" mixer for clay dust preparation and other dry mixing.

G. H. Heath and Son, Heathcote Works, Burslem. This firm's aim is to be able to give complete service to the potter for his many and varied requirements from the slip-house to the packing-house. With this end in view, a modern textile section is operated for the manufacture of filter cloths and industrial overalls. The manufacture of lawns, sieves, colours, glazes, mould natches, palettes and potter's tools is also undertaken, of which examples were on show. A very large sponge section is operated, carrying the largest stocks in the Midlands, sponges being imported direct from the fishing grounds.

E. Sydney Heath, Edward Street, Burslem. Visitors were able to see: "Sneyd" nylon and synthetic filter cloths embodying numerous patent constructions and suspensions.



The stand of Jesshope Ltd., of Longport, Stoke-on-Trent

All types of natural and synthetic sponges for the Ceramic Industry. "Sneyd" enamel and underglaze colours, glazes, stains, etc.

Jesshope Ltd., Langport. On this stand were shown examples of Jesshope machinery for the Ceramic Industry. They included a ball mill in motion and a heavy-type press for use in saggar and fireback manufacture. Also on exhibition were machine tool castings, steel fabrications and tunnel kiln equipment.

Mellor Mineral Mills Ltd., Etruria Vale, Stoke-on-Trent, and Dohm Ltd., Aqueduct Street, Stoke-on-Trent. Mellor Mineral Mills Ltd. (formerly George Mellor and Co. Ltd.) is one of the oldest established firms of potters' millers in the country, their history commencing in 1792.

Development and expansion of milling at Etruria enables this company to offer many varied products for the potter. These include ground flint, stone, felspar, clays, quartz, silica, prepared bodies for earthenware, tiles, porcelain, refractories, etc.

A feature of the organisation is the grinding, pulverising and grading of minerals and ores for many industries.

Associated with Mellor Mineral Mills Ltd., is the well-known firm of Dohm Ltd., who displayed the new insulation material of many uses—Vermiculite.

Podmores (Engineers) Ltd., Shelton, Stoke-on-Trent. This firm showed machinery for the Ceramic and Chemical industries.

Interest was shown in the glaze-cleaning plant of which a wide range is supplied: from the complete dipping tub, to components for fitting to existing tubs. Here the "Cipec" sifter is used in conjunction with the Podmore glandless centrifugal pump. The large version of this pump has been successfully used for many years in the handling of abrasive slips and glazes. While the smaller type, as used on glaze cleaning, has in a number of cases given above two years trouble-free service.

Other exhibits included applications of the electro-magnetic vibrator to feeders and conveyors for metering the flow of granular materials to grinding mills, disintegrators, tile presses, etc.

Also displayed was the agitator bowl for use in sponge-mottling tiles—while a Podmore rubber covered grinding cylinder cover, also on exhibition, showed very little wear after more than 12 years' continuous service on a cylinder grinding fluid.

J. W. Ratcliffe and Sons, Wellington Road, Hanley. On this firm's stand appeared mould making equipment: face parts, back cases and face rings in metal. In addition were the firm's carbide tipper tools, cup sponging machines, etc.

W. Hamilton Reid Ltd., St. Ann's Works, Hanley, and The Metal Crate Co. (Hanley) Ltd., St. Ann's Works, Hanley. The exhibits displayed on these Stands illustrated the activities of two firms whose object is to assist industry during this period of expansion and development.

Hamilton Reid Ltd., specialise in heating, ventilating, drying, vacuum cleaning, and hoist and crane installations. Installations are carried out by skilled engineers following the preparation of schemes by experienced and qualified technicians.

The Metal Crate Co. (Hanley) Ltd., showed a comprehensive range of metal crates of both the rigid and collapsible types.

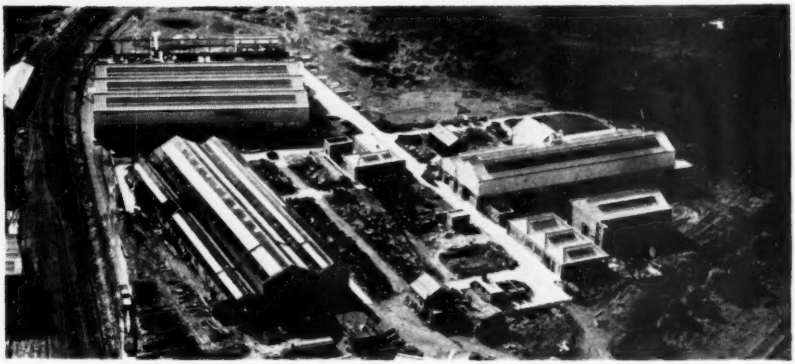
Stewarts (Hanley) Ltd., New Street, Hanley. This firm had two Stands, one of which displayed the tools and general ironmongery, for which they are well known, and a second which showed entilating ducting and sheet metal work from the firm's Gate Street Works.

Stewarts have been established over a century and their display of tools included those manufactured by many well-known firms.

Sneyd Brickworks Ltd., Burslem. Recently re-organised, this company have introduced modern methods in their production of high-grade domestic and industrial refractories. Their products are well-known to the building and iron and steel industries, and among the articles on show were examples of the new tile crank for use in the tunnel kiln firing of wall tiles.

"TUNNEL KILN COSTS"

IN the CERAMICS issue of January, 1951, we included a report of a lecture by Mr. L. Bullin, B.Sc., entitled "Tunnel Kiln Costs," without acknowledgement that this was the copyright of our contemporary, *The British Clayworker*. This was due to an oversight on the part of a member of our staff, which we much regret. However, we have adjusted the matter with our friends at *The British Clayworker*, and we can only express our regret that this slip occurred.



An aerial view of the new Lenches Bridge Works

Gibbons Brothers Ltd. Open New Works

FRIDAY, 8th June, 1951, was an important day for Gibbons Brothers Ltd. It officially signified the opening of their new Lenches Bridge Works, Dudley. The occasion was marked by a luncheon at the Dudley Town Hall, attended by nearly 300 of their customers and business associates.

Colonel N. E. Gibbons, chairman and managing director, said that, although, like so many other building enterprises, the work was behind schedule yet the completion of the engineering works meant that all the various engineering departments which had previously been scattered were now housed under one roof. Undoubtedly this would have a favourable reaction upon delivery dates.

He commented upon the gathering which indicated the diversity of industries which Gibbons Brothers served, and, indeed, it was noticeable to those present how much gas, ceramics and metallurgy were intimately associated with the name of Gibbons Brothers.

A Long Association with Gas

Colonel Gibbons said that it was with the gas industry that they had their longest association and it was one hundred years ago that they made their first retort. He added that their dealings with the gas industry had been practically unaffected by nationalisation.

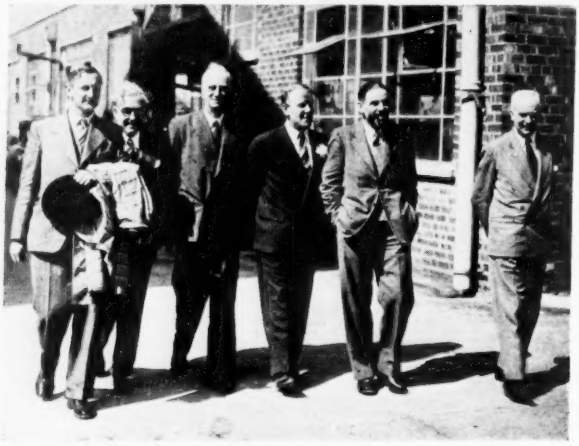
An important industry to Gibbons Brothers which he specifically mentioned was that of metallurgical furnaces for steel, aluminium and non-ferrous metals.

Referring to the ceramic industry, he said that this was their youngest customer, but, even so, it was just twenty-five years ago that his company installed their first kiln.

He welcomed the Mayor of Dudley and the representatives of the various local educational authorities, saying that Dudley had always been one of the most progressive boroughs in the county. He thanked officials of the Ministry of Supply for their help and assistance which had been great, adding jocularly, "that this was quite in order in view of the importance of the enterprise!"

Replying on behalf of the guests, Alderman A. E. Hewitt, managing director of W. T. Copeland and Sons Ltd., a former Lord Mayor of Stoke-on-Trent, added that, although during his term of office as Lord Mayor, he

had often entertained and had been entertained, he could never remember when the entertainment had been so good. He offered a personal word of thanks to Mr. Gordon van Marle whom he felt was the inspiration behind the attractive floral decorations in the dining-room. He pointed out that, although Gibbons Brothers had been in business one hundred years ago and was now a public company, yet the chairman's grandmother had at the start "but a batch of fireclay and two sons!"



At Lenches Bridge Works: (Left to right) H. Moys (W.M.G.B.), L. Hubbard (N.W.G.B.), J. E. Stanier (W.M.G.B.), A. L. Wild (T. C. Wild and Co. Ltd.), E. B. Gibbons (Gibbons Bros. Ltd.), F. Yorath (Wood, Goldstraw and Yorath)

"Known Throughout the World"

Gibbons Brothers became a public company in 1919, and since then the need for high-class refractories had become of ever-increasing importance. In the pottery field the name of Gibbons was known throughout the world. He pointed out to the critics of private enterprise that on the Gibbons' board there were no guinea-pig directors; they were all working directors. He added further that if people with commercial and industrial experience such as Colonel Gibbons were in control of the country, better and more positive results would be achieved.

Mr. Hewitt closed with a tribute to the staff which Gibbons Brothers sent out on to the job. He had had much personal experience with them, and he had always found them to be most interested and very able to undertake the work in question. He wished the company, the directors and the staff the best of luck in the future years.

The origin and growth of the Gibbons' organisation typifies the manner of pioneering characteristic of Britain towards the close of the industrial revolution.

The Gibbons family lived in Sedgley, Staffordshire, the parish in which Gibbons' works is still situated, and from about the year 1720, a junior branch were carrying out business as ironmakers and merchants. In the year 1834, Mr. Benjamin Gibbons of this branch, having found a good grade fireclay on his property, founded the firm of B. Gibbons, Junior, to make fireclay goods for the gas industry, just then commencing to develop. In 1844 Mr. Gibbons, who traded as B. Gibbons, Junior, had four kilns and factory buildings covering 4,700 sq. ft. It is believed that certain gas companies have been regularly supplied with their fireclay goods ever since that time.

Mr. Gibbons died young, and the business was afterwards owned and managed by his widow, Mrs. Emily Gibbons, assisted by her two sons, Benjamin and William Pike. Under their management, it commenced to develop rapidly. Patents were acquired for manufacturing gas retorts by machinery, and for many years, the

production of these was the most important activity of the old firm, output reaching over 100,000 ft. per year before the outbreak of the 1914 war.

In the 1870 decade, Mrs. Gibbons' sons, while continuing to manage the firebrick works, founded a small business of their own to supply sundry items in iron to gasworks, which soon developed into contracting for resetting work, etc. With the aid of Mr. Edward Masters, various improved forms of retort setting, generators and regenerators were invented and by 1894 Gibbons Brothers had developed into a considerable business. A private company was then formed, small premises in Dudley were later vacated, and engineering shops built adjacent to the firebrick works. At the same time, Benjamin Gibbons was made into a private limited company.

Mr. G. B. A. Gibbons, who had been manager for the Liverpool Gas Company, joined the firm a little later in the place of Mr. Benjamin Gibbons who died young. Up to the outbreak of the first world war, Gibbons Brothers continued to develop their contracting side rapidly, opened branch offices at London, Manchester, and in Australia, and carried out important contracts for horizontal or inclined retort systems in most countries of the world. In the same period, the construction of furnaces for the metallurgical industry was commenced. During the first world war, this side of the business developed rapidly and many important furnace plants were supplied, particularly for the annealing of cartridge cases, shell cases, and brass and copper articles generally.

Public Company Formed

In 1919, the two firms were amalgamated, and a Public Company was formed under the name of Gibbons (Dudley) Limited, which company owned and still owns Gibbons Brothers Limited. The first world war had retarded gasworks construction and renewals, so that during the first few years of the peace, Gibbons were busy again on gasworks construction. To meet the heavy demand of this time, a foundry was purchased and new structural steelwork shops were built.

By 1925, the demand for new carbonising plants having somewhat slackened off, it was necessary to branch out further to keep the extended works going to full capacity. Accordingly, the furnace business of Harvey Siemens was purchased in 1925, the ceramic tunnel kiln business of Dressler Tunnel Oven Company in 1927, and rights were acquired to construct the Kogag coke oven in this country. In 1926 Mr. W. P. Gibbons died, and Mr. C. S. Bennet and Mr. T. Allen became joint managing directors of the company—Mr. Allen being sole managing director during the 1930's. As a result of the new development referred to, the company came through the bad period from 1929 to 1933 without undue strain,

At Dudley Town Hall: Included in the group are H. F. Baker (Gibbons Bros. Ltd.), G. Turner (Gibbons Bros. Ltd.), J. Wilson (Ibstock Brick and Tile Co. Ltd.), Col. W. E. Gibbons (Gibbons Bros. Ltd.), the Mayor of Dudley (Councillor G. S. Marlow), Chief Constable C. W. Johnson (Dudley)

and up to the outbreak of the second world war, continued to develop rapidly, the business in ceramic tunnel kilns proving a particularly satisfactory development. The company were the first to introduce the use of town's gas as the fuel to fire these ovens. This proved perhaps the best answer to the problem of firing pottery and is now generally adopted.

During the second world war, the company's activities were again largely centred in the construction of furnaces for the munitions industry. Practically every one of the new explosive plants built in the country were supplied, as well as numerous factories in the aircraft, armour plate and other war industries.

The post-war period is again proving one of rapid development with much work on carbonising plants, on ceramic tunnel kilns, and generally. Complete new machine shops, and large new structural steelwork shops have been built, and a complete new foundry is now completed. Equally important extensions are being carried out on the refractory side of the business.

The New Works

In 1936, with their existing business rapidly expanding, and envisaging further developments in a still wider field of industry, the directors of Gibbons Brothers decided that either an extensive expansive scheme at their Dibdale works or a complete new works would have to be developed as rapidly as possible. The first scheme of expanding at Dibdale works was ruled out, due to lack of space and rail transport difficulties.

After considering several sites, the one finally chosen for the new works was at Lenches Bridge, Pensnett, Brierley Hill. It provided good transport facilities by either road or rail, and lying 4 miles west of Dudley in the gradual incline down to Kingswinford provides an excellent vista of the countryside with all its attendant virtues of space and airiness, a fact amply borne out since the works have been in operation, by the visible and factual records of the health of the employees.

The new works are a self-contained general engineering unit, which consists of constructional plating shops, foundry, machine shops, fitting and erection shops.

The foundry, together with its attendant pattern shop and pattern stores, is situated on the west side of the works. The pattern shop is 100 ft. × 50 ft., and is fully mechanised for the production of patterns of a large and varied nature. It is heated by means of low-pressure steam radiators with fan impellers, a dust extraction plant is being installed with underground ducts to a collector house outside the building. The pattern stores, immediately behind the pattern shop and connected to the foundry and pattern shop by a concrete road, is a two-storey building, 100 ft. × 50 ft. with a light crane in the lower portion for handling heavy patterns, the first floor being required for light patterns, the patterns being hoisted or lowered by means of a light hand-operated lift.

Sand Conditioning Plant

A sand conditioning plant, to supply both facing and backing sand is incorporated, and runs between the main bay and the light foundry. Burnt and used sand is fed into a series of hoppers, placed at convenient intervals in the foundry at ground level, thence it is carried by means of under conveyors to the mixing and conditioning plant, afterwards being elevated to an overhead conveyor that feeds, by means of adjustable ploughs to the static hoppers. These hoppers are fitted with revolving nozzle shoots to feed the sand into either bay as required.

Twin cupolas, situated midway between the light foundry and the core shop, give a ready supply of iron at the most convenient point for the foundry in general.

The main casting bay is equally divided into two depths of sand, one being 2 ft. 6 in. in depth with a concrete bottom, and the other half being 6 ft. in depth with an ordinary earth base that gives no limit to the ultimate depth that may possibly be required at some future date. The castings that can be produced range from a few ounces to 5 tons.

The cupolas are charged by an electric hoist with a travelling skip, this being so designed that when lowered into the charging position,

twin bottom doors come into operation and automatically deposit the charge into a swivel shoot that can be operated to charge either cupola. Every charge is carefully recorded, and the proper constituents as specified by the correct analysis, to suit different duties, is measured by means of a dial-indicator weighing machine adjoining the stocking pens, the whole of the charging mechanism being operated by remote push button control, and the whole charging and analysis of the charges is controlled by a qualified metallurgist, who has at his disposal a small but up-to-date and well-equipped laboratory.

The constructional plating shops are the largest single block in the works, comprising three bays of 50 ft. span by 250 ft. long, these being serviced by two steel stockyards, one being 70 ft. span by 250 ft., and one 60 ft. span by 250 ft.

The machine and fitting shops occupy a building 336 ft. long by 120 ft. wide, comprising a main centre bay, with a 50 ft. span and flanked on either side by a smaller bay 35 ft. span.

Machine Shop

The machine shop is equipped with a large and varied selection of machine tools, the largest being a centre lathe capable of turning a diameter of 8 ft. in a 3 ft. gap. The production of this shop comprises the mechanical gearing, etc., for the tunnel kilns, mechanical furnaces, retort mouthpieces, pushers both mechanical and hydraulic, and patent charging machines.

As in the other departments production varies from chain parts that weigh but a few ounces to the largest charging machine the company have so far built which weighed 56 tons unloaded, with a load handling capacity of 25 tons, giving a complete load of 81 tons.

The whole of the works are connected by a series of roads radiating through, or from, a central yard.

DRAGLINE EXCAVATORS

THE North British Locomotive Co. Ltd. is to start production of heavy earthmoving and handling equipment under an arrangement with Jack Olding Ltd. of Hatfield. Large dragline excavators for which a very considerable demand exists at home and abroad are to be built, the first order being for 25 units. These are to the design of the Baldwin-Lima-Hamilton Corporation of the U.S.A.

The arrangement will enable British users and Empire users the readier use of American type plant since production is on standard lines.

North British are locomotive specialists and seldom work outside that field, although their facilities and personnel make them uniquely suited to the production of the dragline excavators.

ESTABLISHED 1913

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DRYING OF SANDS FOR GLASSMAKING*

By ERIC SEDDON, Ph.D.

Director of Research, The United Glass Bottle Manufacturers Ltd.

IN most commercial glasses silica is a major constituent, being present in the proportion of 70-80 per cent. by weight. The raw material used to introduce silica into glasses is thus of considerable importance in determining the quality of the ware.

Normally a sand—produced by nature over many centuries by the gradual breaking-down of rocks, or alternatively produced artificially by man, crushing pure sandstones—is the raw material adopted. The sand must (a) conform to certain standards of chemical composition and purity; (b) possess a mechanical grading which favours successful glass melting and refining; (c) have an appropriate moisture content when used; and (d) must be available, with all these desirable properties, in large tonnages.

Each of these requirements has an important bearing on the processing to which the raw sand intended for glassmaking is subjected and, as will be seen, renders essential the separation of moisture from the sand grains.

Chemical Composition and Purity

The sands used for glassmaking must have a silica content of 98 per cent. or over; in addition, for colourless glasses the proportion of iron- or chromium-containing impurities must be very low indeed, since they impart undesirable colours to the glass. The amounts of iron and of chromium which can be tolerated in sands vary according to the type of glass; approximate limits of Fe_2O_3 in sands would be 0·05 per cent. for flat glass, 0·03 per cent. for colourless bottles, 0·01 per cent. for tableware and below 0·01 per cent. for lead-crystal and optical glasses. For colourless bottles the chromium content of the sand should not exceed 0·0005 per cent. Cr_2O_3.

To obtain these degrees of purity, sand suppliers, certainly those in Britain, must water-wash, some must, in addition, remove heavy minerals, and some must further use chemical treatments. In all these processes large quantities of water or of dilute chemical solutions are involved and, in the final stages, the ultimate sand product must be separated from these aqueous media.

Mechanical Grading

For glass melting to proceed evenly the batch materials, as a whole, should have a reasonably uniform particle size; the difficultly-fusible sand grains must be of fairly uniform grading, and if the glass melting is to proceed rapidly the sand grains should be fine, corresponding to the geologists' "medium" grade, i.e. 0·25-0·5 mm. dia. Coarser sand particles, if used, might pass through the furnace without dissolving; fine sand grains are carried over more easily into regenerators, accelerating choking.

To meet the requirements of grad-

* A paper presented to the North Eastern Section, Institute of Fuel—15.1.51.

ing as well as purity, the sand producer may have to wet sieve or elutriate. As a consequence, the sand grains must again be separated from water used in the treatment.

Moisture Content

Some glass manufacturers, probably a minority, prefer to have dry sand, firstly for easier elevating, storing and running off for weighing, and secondly for keeping closer control on glass composition, a very essential condition when glass is being handled by fully automatic machines. Moist sand is, however, quite extensively used in glassmaking, and some manufacturers suggest, rightly or wrongly, that glass melting and refining are accelerated when a moist batch is used.

Dry sand is too free-flowing to be transported loose in trucks; to bag the sand would increase costs and probably lead to higher railway rates. The sand is therefore generally dispatched by rail or road in a moist state, and an allowance for moisture content is made in fixing costs and in assessing payments due.

The sand requirement for the British glass industry as a whole approaches 1 million tons per annum. Of this quantity only a proportion is processed and purified; a still smaller fraction is dried.

In one of the seven glass factories of the company with which the author is associated nearly 40,000 tons of sand are dried in a year, from an average moisture

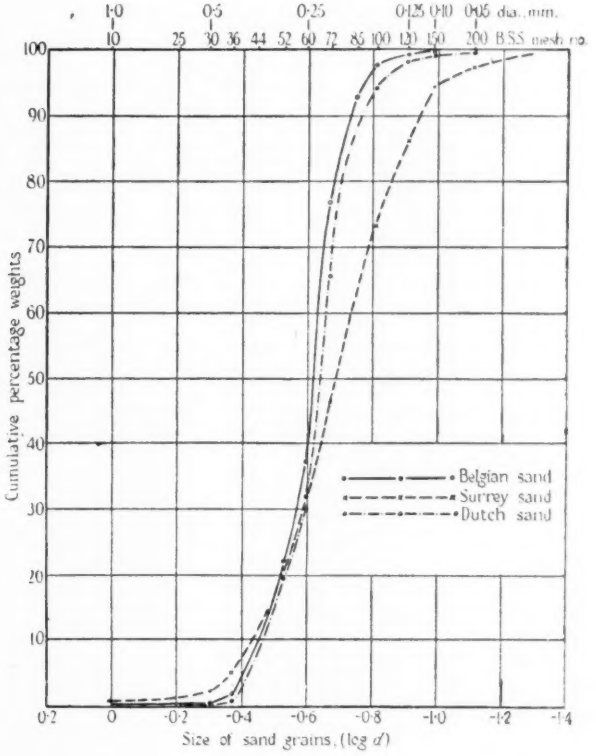

Fig. 1. Mechanical analyses of certain glassmaking sands (for colourless glass)

content of 10 per cent. (the maximum might reach 15 per cent.) to a final value which approaches zero, and must certainly be less than 0·3 per cent. This sand drying plant runs for two out of three 8 hr. shifts per day, for 6 days of the week; it must handle some 10-12 tons/hr. of sand, giving virtually zero moisture content in the dried sand.

Characteristics of Glassmaking Sands

The sand grains which result from the slow, natural breaking down of rocks, or from the quicker, mechanical crushing of sandstones, etc., must clearly comprise individual mineral fragments of the parent rocks. Quartz is the predominating mineral; felspars are present to lesser extents, and there is, too, the heavy mineral fraction which, though present in small percentages (0·01-0·6 per cent.), can contribute appreciable iron as well as chromium impurities.

The glassmaking sands are thus largely composed of angular or subangular, hard abrasive, difficultly-fusible, non-porous particles, with "diameters" ranging from 0·1-0·5 mm. Fig. 1 indicates the cumulative mechanical gradings of certain sands now being used for glassmaking.

In wet sand the moisture is held partly in the interstices between particles, but mainly as a thin film clinging to the surface of the quartz grains.

The problem of drying glassmaking sand, apart from the fairly large tonnages involved and the abrasive action of the hard quartz grains, should thus be appreciably easier to solve than the drying of, say, combustible or porous materials.

Separating Water from Glassmaking Sands

Amongst methods known to the author to be in use commercially, either by sand producers or by the glassworks themselves, are: (a) draining systems and (b) filtering processes; while tests have also been made using (c) discontinuous- and continuous-type centrifuges, (d) pneumatic dryers and (e) thermal dryers.

Since in the present study of drying, it has been decided to exclude filtration, pressing, centrifuging, crystallisation and sedimentation, only brief consideration will be given (c), (d) and (e) above.

Draining Systems

A stockpile of sand may be laid down on suitable natural ground or on a carefully prepared site—say, on wooden slats which lie on a porous bed of gravel, which in turn rests on a concrete base with runways for the drainage water. After the sand has been standing for 24-48 hr the moisture may be reduced to 5 per cent.

This method, given suitable ground, can deal with large outputs; initial costs and maintenance costs are low. The amount of contamination is small.

Filtering Processes

Vacuum filters, although requiring high capital outlay and needing considerable maintenance, are used by some sand producers. They can easily handle 10-12 tons/hr. of sand reducing the moisture to about 8 per cent. in the more efficient systems. Such plants normally work 24 hr. per day for 6 days per week. The degree of contamination is small, even when chemical solutions have to be separated; special metals or alloys and suitable filtering media may be necessary.

Centifruges

Centrifuging would seem to be well suited to the separation of water from sand grains, except perhaps for possible abrasion by the quartz particles.

Although the author is lacking in experience of continuous operations on a commercial scale with centrifuges he may perhaps with advan-

tage refer to some tests made with glassmaking sands on a semi-commercial scale, using both discontinuous and continuous types.

Discontinuous centrifuging enabled the moisture content of the sand quickly to be reduced to a value below 1 per cent. To reduce abrasion and its effect on contamination, special materials such as stainless steels (possibly rubber coated) would have to be employed. High outputs would be difficult to maintain, even with the largest discontinuous centrifuges.

Continuous Centrifuge

In a continuously operating centrifuge of the "solid bowl" type, wet sand could be de-watered to a moisture content of less than 3 per cent. This centrifuge comprised a conical cage with liquid outlets at the larger diameter end and exits for the de-watered sand at the smaller end. A spiral scraper, inside the cone, moving at a relative speed of 5 r.p.m. to the latter fed the de-watered material along the cone to the discharge point.

For an output of 10 tons per hr. the capital cost of a continuously operating centrifuge would be £3,000-£4,000 plus the cost of the auxiliary equipment. The space occupied would be only 5 ft. long by 4 ft. wide. Power requirements would be some 40 b.h.p. for the main drive and 18 b.h.p. for the scraper drive. Possible disadvantages include abrasion, with its effect on maintenance costs; there is, too, the difficulty of obtaining really dry sand.

Pneumatic Dryers

In pneumatic drying systems, hot air or hot gases are blown into the bottom of a long vertical tube, the material to be dried (in this case sand) being introduced into the tube at a short distance from the bottom. The sand feed must be continuous and must be even if the desired final moisture content is to be maintained, if the output of dried sand is to be kept up and if maximum thermal efficiency is to be realised.

As the sand falls, individual quartz grains, with water on their surfaces, meet the column of rising hot gas, are arrested in their downward movement, have their directions reversed and, finally, are slowly accelerated upwards, the whole cycle taking several seconds. The moisture from the surface of the sand grains is quickly swept away by and transferred to the hot gases.

The air or gas should leave the drying column at 75°-80° C., i.e. above the dew point.

Separators allow the dried sand grains to be divided from the air stream, which is then diverted to atmosphere.

Heat Source

When drying sand the grains of which are thermally stable, it is customary to use the direct products of combustion of gas, coal or oil as the source of heat. By employing high initial temperatures, the drying can be speeded up, thermal efficiencies can be raised and running costs reduced.

Contamination can be minimised by constructing the drying column in a metal which can contribute little or no iron or chromium impurities to the glass; non-metallic materials can be employed. The abrasive action of the sand grains must, of course, be borne in mind.

Pneumatic dryers can handle outputs of 10-12 tons/hr. of sand and are economical of ground space.

Thermal Dryers

The author's main experience of drying sand for glassmaking lies in the field of rotary dryers, the designs of which are well known and need no detailed description here.

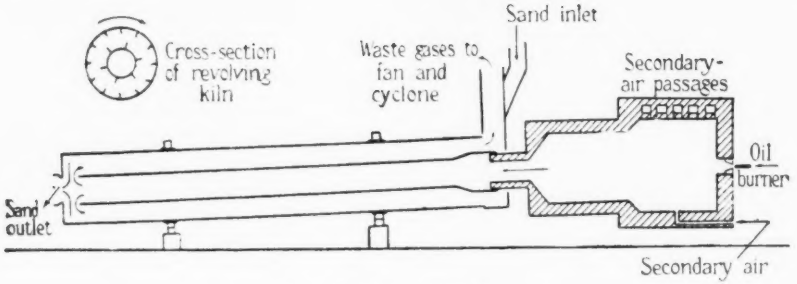

Fig. 2. Rotary sand dryer

Single-shell dryers offer the advantages of simplicity and accessibility; they are, however, less efficient thermally than the double-shell dryer and need to be larger than the latter for a given sand output. Our own company's preference is for the double-shell dryer, which is suitable for materials capable of withstanding temperatures above, say, 300° F., and which are unharmed by coming into contact with the products of combustion. Sand is clearly a material in this thermally stable category.

The fully mechanised double-shell dryer at the works of United Glass Bottle Manufacturers Ltd., is of the normal type, comprising two concentric cylinders in steel plate, with an annular space between them as shown diagrammatically in Fig. 2. The dryer is 30 ft. long with an inner cylinder dia. of 2 ft. and an outer cylinder dia. of 5 ft. There is a 1 ft. fall towards the sand exit end.

Gases from a furnace which is now oil-fired but formerly was coke-fired pass through a throat into the inner cylinder, proceed along the latter, then return through the annular space, being finally exhausted to atmosphere by an induced draught fan. The gas temperature falls from a temperature over 1,500° C. at the throat to about 450° C. at the discharge end of the inner cylinder. At the point of exhaust the waste gas temperature, in a recent test, was down to 52° C. From these temperatures alone it is evident that: (i) much of the heat in the combustion gases is imparted to the inner cylinder; (ii) the heat lost through

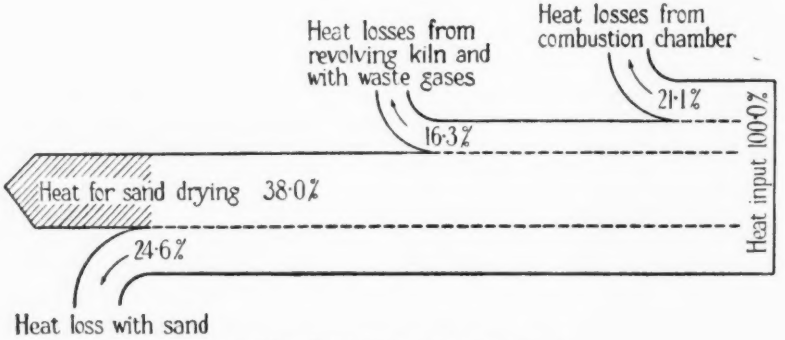

Fig. 3. Heat balance of rotary sand dryer

the outer shell cannot be excessive, since the mean temperature in the annular space is moderately low; and (iii) the heat lost to atmosphere in the waste gases is fairly small.

A bucket elevator takes the wet sand into the annular space at the furnace end of the dryer. (The feed should be even, continuous, and not excessive.) Lifting flights on the inside of the outer shell raise the sand to the top of the dryer, whence it drops on to the hot inner shell, where it is retained by the radial flights for the next half revolution. Thus, the wettest sand comes into contact with the greatest source of heat. Proceeding along the dryer, the sand is drying and is being raised in temperature, both by contact with the hot inner cylinder and by the counter flow of hot gases as the sand grains drop downwards in the annular space. At its discharge point, dry sand at a temperature of 75°-100° C. is in contact with dry gases. The hot gases pick up more and more moisture as they pass to the exhaust fan.

A bucket elevator removes the dried sand to a hopper for wagon loading.

Pool fuel oil, preheated to about 160° F., fed through two hand controlled Universal burners, provides the heating medium. Secondary air for combustion is preheated by passing inside the double crown and under the siege.

Thermal Balance, Fuel Cost, Etc.

Fig. 3 is a Sankey diagram based on a heat balance carried out recently on the older, double-shell, rotary dryer at the U.G.B. works. When this test was made the output was a maximum (12·2 tons/hr. dry sand) whereas the moisture content of the wet sand was extremely low (3·7 per cent.). Thus under average conditions, the thermal performance may be less favourable than in the present heat balance, details of which are given in Table 1.

TABLE 1. HEAT BALANCE OF A SAND DRYER.

Heat input				*Heat consumption*			
Symbol	*Item*	*B.Th.U./ min.*	*Per cent.*	*Symbol*	*Item*	*B.Th.U./ min.*	*Per cent.*
H_1	Heat input with oil fuel	43,000	100·0	H_1	Heat used for drying	16,300	38·0
				(H_1-H_2)	Heat losses from the furnace chamber	9,100	21·1
				H_3	Heat losses with dried sand	10,600	24·6
				By difference	Heat losses from the revolving kiln and with the waste gases leaving the dryer	7,000	16·3
	Total	43,000	100·0		Total	43,000	100·0

At the time of this test the thermal efficiency was 38 per cent. and the ratio of sand dried to oil consumed 185:1; but for the 3 month period August to October, 1950, including idle periods, time spent in warming up the dryer, etc., the average sand/oil ratio was 110:1. The difference is due to the varying moisture contents in the wet sand during the second period. At 9d. per gallon the fuel cost is thus approximately 1s. 8d. per ton of sand.

The electric motors used on the sand dryer are: (i) 15 h.p. for the main drive for rotating the shells; (ii) 10 h.p. for the exhausting fan for the cyclone; (iii) 5 h.p. for the wet sand elevator; (iv) 5 h.p. for the dry sand elevator. Measured power consumptions were respectively 12·7, 5·0, 2·2, and 2·8 kw. This would add approximately 2d. per ton for electrical power to the above 1s. 8d. per ton for oil fuel.

Costs

On the criteria previously discussed, this double-shell rotary dryer gives the desired output, and yields sand with virtually zero moisture. The space occupied is considerable, for there must be hoppers, sand elevators, and a building to cover the rotary dryer, furnace, etc. The initial cost would be of the order of £5,000 for the dryer alone, and approx. £13,000 for a complete plant capable of drying 12 tons/hr. of wet sand (10 per cent. moisture to be removed). Maintenance costs are high with these rotary double-shell dryers; the flights and the supporting struts wear rapidly and must add a minute additional trace of iron to the glass. To add 0·005 per cent. Fe_2O_3 to the sand (an amount readily detected), $\frac{1}{2}$ cwt. of iron or steel would have to be removed per week; direct tests for contamination, as the sand passes through the dryer, have never indicated any detectable pick-up.

In spite of their disadvantages, rotary dryers are quite widely used for drying sands for glassmaking.

Future Trends

The thermal efficiencies of rotary dryers will, it is hoped, be improved by applying further insulation to the furnace, by preventing the entry of so much cold induced air at the oil burners, and by minimising the excess air drawn in at the point of sand feed. Better control on the sand feed may avoid the serious difficulties encountered when dealing with optimum outputs of particularly wet sands.

It is difficult to generalise on future long term trends in sand drying, for the choice of plant must depend on the degree of dryness required, on output, on flexibility, on reliability, on space occupied, on capital cost, on plant life, on maintenance costs, on fuel costs, on electrical power costs and on labour costs. Where technical requirements are met equally, overall economics will determine the final choice.

Bearing in mind present fuel costs and remembering that per ton of dried sand the cost of oil fuel and electrical power amounts to 1s. 10d., one's thoughts must be attracted to non-thermal processes, particularly those which can give low moisture contents, high output, continuous operation, and which take up little ground space. The abrasive nature of the sand grains must always present certain difficulties, in causing wear and in increasing iron (and chromium) impurities in the glass. If centrifuges could overcome these drawbacks without imposing excessively high maintenance costs they would constitute an extremely attractive proposition for the future. Centrifuges being as yet unproved for commercial glassmaking sand treatment, thermal dryers of one type or another will continue to be used for the present and in the immediate future.

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The author would like to express his very sincere thanks to the directors of the United Glass Bottle Manufacturers Ltd., for the opportunity of preparing and presenting this paper.

BRICK MANUFACTURE IN SCOTLAND

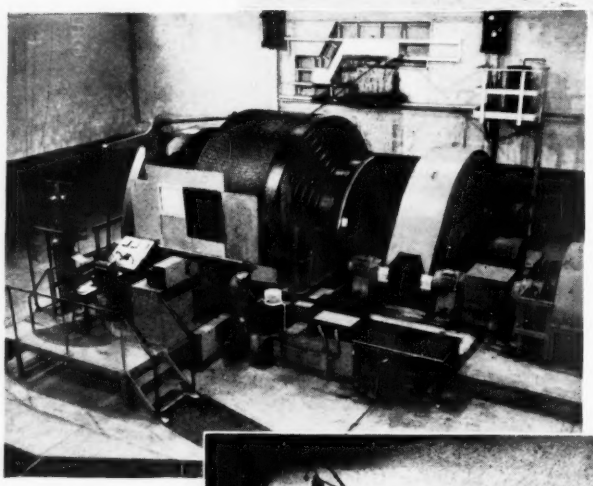
PLANS have been mooted for the production of bricks at Corpach in Lochaber from local materials. An Aberdeenshire firm of quarrymasters and brickmakers are interested in the project and plan to operate if local support is forthcoming. Inverness County Planning Committee is being asked to support the venture which would be a new one for that part of Scotland. In the past the great bulk of bricks used in building in the Western Highlands have been shipped from the Central Scotland industrial zone although smaller supplies come from other areas, including a fair amount of seaborne bricks of special type from England. Inverness County has agreed to investigate the possibility of using locally produced bricks on local housing schemes in the area and development now depends on the success of their investigations as to suitability.

Utilising Spent Shale

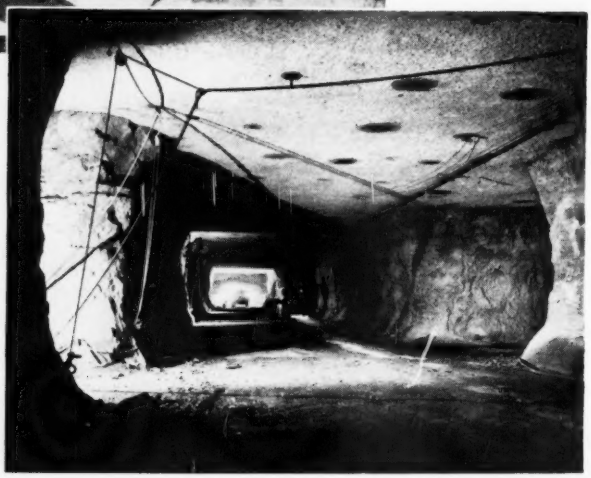
The fact that the petroleum industry produces a considerable output of good quality building brick in Scotland was noted at the "Exhibition of the Petroleum Industry" staged in Glasgow's Royal Technical College in May. Scottish Oils Ltd. at Pumpherston have been responsible for a dual purpose in turning brickmakers—in utilising spent shale as a raw material, and in eliminating these giant bings which mark the shale oil areas of Scotland. The brick made at Pumpherston is a 30,000/40,000 compressive strength spent shale lime brick of good building quality. It is used extensively in industrial construction work in the area and also for house building and allied purposes over a very wide area of Scotland.

The raw material is drawn from the spent shale spoil heaps, mechanical methods being used and is processed by normal brickmaking plant before being heated for 8 hours in an H.P. autoclave.

Surface view of the Columbia Chemical Division's limestone mine at Barberton, Ohio, U.S.A.



Above ground this automatic hoisting apparatus lifts 10 tons of stone from the half-mile deep mine



Horizontal view of the Barberton mine showing excavated "rooms" off both sides of the long, tunnel-like "entries." Total length of excavated area is approximately 3 miles

MINING LIMESTONE —half a mile down!

AN AMERICAN CORRESPONDENT

When our American Correspondent sent in this article we were amazed that the vast capital expenditure was worth while for a private company, such as Pittsburg Glass, to overcome freightage and stock-piling. The problems of mining coal in Britain are relatively more important to us. But bulldozers, cafeterias, drinking water and air conditioning down a mine? Has the National Coal Board sufficient imagination to profit by this realistic enterprise?

TEN years ago at Barberton, Ohio, U.S.A., the Columbia Chemical Division of Pittsburg Plate Glass Company began a pioneering business venture. It was the climax to more than a quarter century of dreaming and planning by expert chemical engineers, when drilling crews began to sink shafts to extensive limestone beds situated nearly a half mile below the earth's surface.

Six Feet a Day

Twin shafts, 550 ft. apart, were driven into the Ohio farmland 2 miles north of Columbia's huge alkali producing plant. Drilling and mining crews, advancing an average of 6 ft. a day, blasted and drilled straight down through scores of sandstone and shale formations.

The engineers were on their way to a limestone strata formed millions of years ago when the area was part of an ocean floor. They were on their way to a 345 ft. thick deposit of limestone identified by geologists as limestone of the Devonian Age. (Van Nostrand's Scientific Encyclopedia states that the Devonian Age began 330,000,000 years ago and continued for 50,000,000 years.)

To extract this mineral at Barberton, engineers were going deeper into the earth than man had ever gone for this common raw material which is so essential to the manufacture of heavy chemicals.

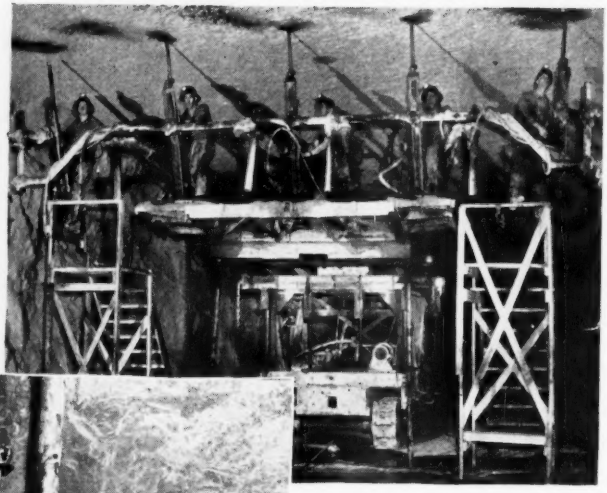
Mining at this depth would be expensive, engineers knew that the advantage would be a guaranteed steady supply of limestone of high lime content. In addition expensive freight charges would be eliminated and the necessity of maintaining huge stockpiles of the material during winter months when the Great Lakes are ice-locked would be minimised.

More than 400 days were required to sink the vertical shafts, measuring 16 ft. by 7 ft. to the level of the limestone deposits. The shafts' walls were framed with steel and lined with concrete, one to a depth of 2,323 ft. and the second to a depth of 2,258 ft.

Difficulties Overcome

Boring through the first 300 ft. beneath the surface, the engineers encountered water flowing at the rate of 60 gallons a min. This flow was collected into a sump and delivered back to the surface by automatic pumps. Oil in small quantities was encountered at a depth of 520 ft. Slight pockets of methane gases were found around the 2,000 ft. depth. However, these gases dissipated rapidly and were of little difficulty to the mining crews.

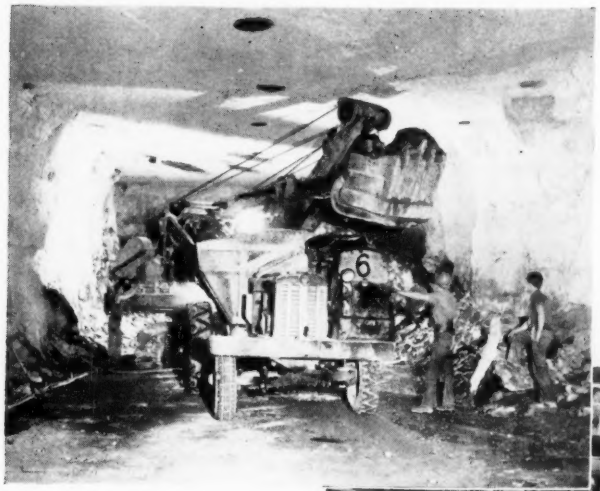
Each shaft was operated on four 6 hr. shifts, the operation proceeding seven days a week. An average of 22 lb. of dynamite was utilised in blasting each foot of shaft.



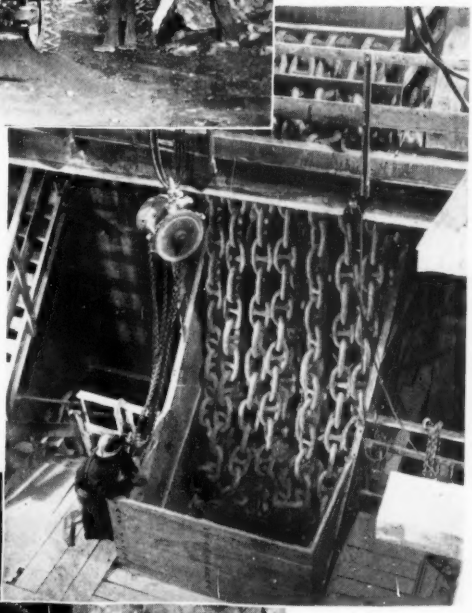
Drilling crew working from a Jumbo drill platform

Hydraulic drill being used in drilling rock preparatory to blasting operations

In the morning, following blasting operations, scaling crews examine the walls and ceilings for loose rock. A "scaler" is seen working from a bucket attached to this long armed scaling rig, capable of hoisting the workman to a 46 ft. ceiling



Electrically operated shovels are used to load the loosened limestone into diesel driven dumper trucks



The stone, some of it in sections weighing several tons, is dumped into a chute behind these revolving chains. The operation checks the fall of the stone, keeps chute from jamming

An endless conveyor belt system carries the limestone to the underground crushing area

Altogether about 100,000 lb. of the explosive was discharged in the blasting operations as the drillers and miners bored through the shale and sandstone formations towards the Columbus limestone strata.

In the provision of "rooms" to house the underground crushing unit, a transformer room, conveyor galleries, and the 550 ft. "drift" connection between the two shafts, more than 30,000 tons of rock were removed to provide working room for the crushing and conveyor equipment.

Equipment Difficulty

Possibly the greatest difficulty in the entire period was encountered in transporting downward to the mine the mammoth equipment needed to operate the so-called "deep lime" operation. All heavy equipment had to be dissembled, lowered to the limestone bed, and reassembled by skilled workmen.

To get the mining operation under way, crushing equipment capable of smashing stone weighing up to 3 tons, had to be lowered to the working surface and assembled. Tractors, large diesel-driven dump trucks, heavy electric powered shovels, equipment for the transformer room all had to be broken down and then reassembled within the mine. Much of the equipment had to be specially designed so that it could be lowered through the shaft compartment.

Today a working force comprised of miners and skilled workmen such as electricians, boilermakers, painters, riggers, are producing the limestone essential to the operation of Columbia's huge Barberton chemical plant.

Some of the miners working the "deep lime" operation are rugged men of Finnish extraction, long experienced in mining copper and iron ore in Michigan's deep mines. Some are experienced in Tennessee copper mining. Many of the 200 man crew operating Columbia's deep limestone mine are skilled craftsmen, such as electricians and riggers, etc.

Method of Development

The mine itself is now a series of rectangular rooms about 32 ft. wide with a ceiling of 28 ft. Mining engineers call the development method such as the one used at Barberton "a two-entry room and pillar method of development."

To the layman, the mine openings appear to be long, level, rectangular tunnels blasted out of solid limestone. The walls and ceilings appear no rougher than a rough plaster wall at home.

Mining Operation

At the advanced working surface holes are drilled into the limestone rock with pneumatic drills mounted on labour-saving, mobile rigs. The drills with detachable bits, bore holes just far enough apart for the dynamite charge to break limestone rock suitable in size for the crushing equipment.

A highly trained group of men, expert in handling explosives, take over after all other miners have been checked out of the mine. Actual explosion or "shooting" is done by means of electric delay blasting caps.

The dynamite charge releases great masses of rock, tearing huge, gaping holes in the limestone wall. As much as 1 ton of explosive is used each night in the operation.

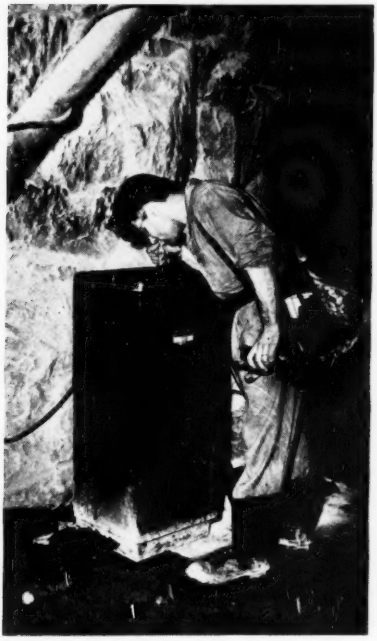
"Scalers" move in the following morning to pry loose rock from the walls and ceiling. Giant electric shovels mounted on caterpillars follow. The blasted limestone, some in sections weighing several tons, is loaded by electric powered shovels into diesel-driven dump trucks.

The primary crusher, located within the mine, "chews" the stone so that the largest piece is no larger than 6 in. in diameter. A conveyor belt system passes the mineral to a 400 ton capacity storage bin from

which it is lifted up the production shaft by automatically operated 10 ton capacity "skips."

Surface Operation

In the surface operation, the stone again is passed on broad rubber conveyor belts to the screening mill. Electric lorry cars transport stone screened from 1-6½ in. sizes to the alkali plant. About half of the remaining stone which is less than 1 in. in diameter, is processed into



Water from the company's own filtration station is piped down into the limestone mine

agricultural limestone and the balance goes into various sizes of commercial aggregate for asphalt, concrete manufacture, road construction and so on.

Rock temperature in the mine is 83° F. but a down draft ventilating current, forced down the service shaft at the rate of 100,000 c. ft. per minute, supplies ventilation and

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lowers the temperature to about 70° F. The forced air current is directed down the service shaft, passes through the working areas and returns to the surface through the production shaft. When desired, the direction of air flow can be reversed.

A safety control on the dump trucks moving to and from the crusher is maintained by a series of red and green "stop and go" lights.

Drinking water from Columbia's own filtration station on the surface flows down through a half mile of pipe to the electrically cooled water fountains. Located in the brightly lighted working area near the service shaft entrance are the machine repair shop, transformer station, mess hall and other permanent installations which give the mine area the appearance of an underground factory.

A quarter century after Columbia's engineers first dreamed of mining the "deep lime," thousands of tons of the mineral weekly are flowing from the mine into lime kilns at the alkali producing plant 2 miles distant.

There, in combination with salt and fired by coke, the lime is used as an essential raw material in the process producing soda ash, caustic soda, and numerous other alkali products all vital to American industry.

DURABILITY IN BUILDINGS

RECENTLY has been issued British Standard Code of Practice CP 3—chapter IX (1950) dealing with the functional requirements of buildings in so far as deterioration is concerned. It is issued at a price of 4s. post free from The Council for Codes of Practice for Buildings, Lambeth Bridge House, S.E.1. Although most of this Code of Practice deals with the effect of deterioration upon wood and metals, reference is also made to the effect upon ceramic materials. It states:

Cement Products

(*a*) Concrete, mortars, renderings and other cement products are liable to suffer decay through various agencies. Frost, wetting and drying movements, and thermal movements are important in differing degrees among the natural causes of deterioration, while the action of acid atmospheres, of liquids and of sulphates from various sources are of special importance under particular, but not infrequent, conditions.

(*b*) The action of frost is, in general, only serious with cement products which are relatively weak or porous or contain aggregates susceptible to frost action; where the material is likely to be exposed to severe conditions, care should be taken to ensure that the products are of high durability in this respect.

(*c*) Movements due to changes in moisture content or to thermal changes may result in cracking and, as a result, in local disintegration. Care should be taken in choice of materials and design to minimise or avoid such cracking. Surface erosion of some materials of this type may also be due to wetting and drying and thermal effects; where such erosion may matter, care should be taken to choose materials and finishes which are known to be resistant to erosion.

(*d*) Erosion or decay of cement products resulting from acid attack or leaching may occur in various circumstances, as for example:

(i) In highly polluted atmospheres.

(ii) Where acid fumes are discharged.
(iii) In ground waters contaminated by industrial wastes or having acidity due to carbonic acid or sulphuric acid.
(iv) By contact with water supplies which are very pure, e.g. mountain water in sandstone or igneous rock areas, or are acid in character, e.g. peaty water.
(v) By contact with acid sewage.
(vi) Under conditions of exposure to spillage or splashes of acid or certain other liquids.

Precautions in Design

Where any of the above conditions may arise, precautions should be taken, in design, by the use of special qualities of material or special types of cement or aggregate, or by methods of protection of the concrete.

(*e*) Decay of cement products, or expansion effects causing damage to adjacent materials or parts of a structure, may result from the chemical action of sulphates under moist conditions upon cement. Contact with sulphates, leading to such effects, may occur in many ways, among which the following are common:

(i) Concrete in soils or ground water containing calcium, magnesium or alkali sulphates.
(ii) Concrete in sea water.
(iii) Concrete or mortar in contact with effluents containing sulphur compounds which form sulphate deposits.
(iv) Concrete enclosing air spaces containing gaseous sulphur compounds which form sulphate deposits.
(v) Concrete, mortar or renderings in contact with moist brickwork, where the bricks contain appreciable amounts of sulphate.
(vi) Concrete or mortar in contact with rubber, clinker, or other filling material or hardcore containing sulphate.
(vii) Industrial concrete floors or other concrete or mortar exposed to spillage or splashing of materials containing sulphate.

Damage from sulphate action can often be reduced, or even prevented, by use of sulphate-resistant types of cement. In sea water or sulphate-bearing soils, the use of a dense and relatively impervious concrete is important and may, in many circumstances, give adequate resistance where a more porous concrete would fail.

Stone

Decay of building stone results mainly from frost action, from pollution of the atmosphere by sulphurous acid, and from crystallisation of sea-salts or salts derived from the soil.

(*a*) The most important cause of decay of stone is probably atmospheric sulphurous acid. This constituent of the atmosphere, arising primarily from the combustion of coal and therefore being greater in amount in urban areas, reacts with calcium and magnesium carbonates, eventually producing sulphates. Limestones of all types, and those sandstones and slates that contain calcium or magnesium carbonate, are directly affected. The action causes erosion of the surface, but this is usually of relatively minor significance; the secondary effects of flaking and disintegration, resulting from crystallisation of the sulphates within the pores of the stone, are more serious. The secondary effects can occur in other materials used in positions such that they can absorb dissolved salts formed in the types of stone mentioned above. All these effects are usually more pronounced in sheltered surfaces than in positions freely exposed to rain.

Care should be taken in the selection of building stone according to

TABLE I. CLASSIFICATION OF SULPHATE SOIL CONDITIONS AFFECTING CONCRETE, AND RECOMMENDED PRECAUTIONARY MEASURES

Classification of soil conditions			*Precautionary measures*		
				Cast-in-situ concrete	
Class	*Sulphur trioxide in ground water (Parts SO_3 per 100,000)*	*Sulphur trioxide in clay (per cent. SO_3)*	*Pre-cast concrete products*	*Buried concrete surrounded by clay*	*Concrete exposed to one-sided water pressure, or concrete of thin section*
1	Less than 30	Less than 0·2	No special measures.	No special measures, except that the use of lean concretes (e.g. 1 : 7, or leaner, ballast concrete) is inadvisable if SO_3 in water exceeds about 20 parts per 100,000. Where the latter is the case, Portland cement mixes not leaner than 1 : 2 : 4, or, if special precautions are desired, pozzolaniccement or sulphate-resisting Portland cement mixes not leaner than 1 : 2 : 4 should be used.	No special measures, except that when SO_3 in water is above 20 parts per 100,000, special care should be taken to ensure the use of high quality Portland-cement concrete, if necessary 1 : 1½ : 3 mixes; alternatively, pozzolanic cements or sulphate-resisting Portland cement may be used in mixes not leaner than 1 : 2 : 4.
2	30 to 100	0·2 to 0·5	Rich Portland cement concretes (e.g. 1 : 1½ : 3) are not likely to suffer seriously, except over a very long period of years. Alternatively, either pozzolanic, sul-	Rich Portland cement concretes (e.g. 1 : 1½ : 3) are not likely to suffer seriously over a short period of years, provided that care is taken to ensure that a very dense	The use of Portland cement concrete is not advisable. Pozzolanic cement or sulphate-resisting Portland cement or, preferably, either high-alumina cement or

			phate-resisting Portland, high-alumina or supersulphate cement should be used.	and homogeneous mass is obtained. For most work, and particularly if the predominant salts are magnesium or sodium sulphates, concrete made with either pozzolanic cement, sulphate-resisting Portland cement, high-alumina cement or supersulphate cement (1 : 2 : 4) is advisable. See Note 1.	supersulphate cement is recommended.
3	Above 100	Above 0·5	The densest Portland cement concrete is not likely to suffer seriously over periods up to, say, 10-20 years, unless conditions are very severe. Alternatively, high-alumina or supersulphate cement concretes should be used.	The use of high-alumina or supersulphate cement concretes is recommended.	The use of high-alumina or supersulphate cement concretes is recommended.

NOTES: 1. Where 1 : 2 : 4 concrete is mentioned, other mixes of equivalent weight ratio of cement to total aggregate, but with somewhat increased ratio of sand to coarse aggregates (e.g. 1 : 2¼ : 3¾, or even 1 : 2½ : 3½), may be used, sometimes with advantage. It may be necessary when using supersulphate cement to employ mixes somewhat richer than 1 : 2 : 4 in order to obtain adequate workability.

2. Adequate assurance should be obtained that cements claimed to be sulphate-resisting Portland cements have, in fact, a high resistance to sulphates. Where the whole of the work, under adverse conditions, cannot be done with resistant cements, protection should be given either by casing with a layer of resistant-cement concrete or by coating with bituminous materials.

the conditions in the district, the design of the building and the durability required. Experience is the best guide in making a selection of stone, but laboratory tests can give some guidance where practical experience is lacking. Consideration should also be given in the design to the possible effects of detailing upon the resistance to decay.

Preservative Treatments

Stone preservative treatments are not generally to be recommended; they are evanescent in their effects and may, on occasion, be harmful rather than beneficial. Where circumstances permit, the removal of decayed stone and thorough cleansing of the surface by water or steam (avoiding the use of soda or other alkaline detergents) helps to reduce further decay.

(*b*) Frost causes damage to certain varieties of building stone if they are used in positions in which they can become saturated with water, as, for example, in unprotected parapet copings, cornices, sills and string courses, and in plinths not protected by damp-proof courses. Care should be taken to use only stone known by experience, or shown by laboratory test, to have a satisfactory resistance to frost action in such positions.

(*c*) Soluble salts of any type may cause failure by crystallisation within the pores of the stone. Precautions should be taken to prevent contamination of the stone by such salts.

(*d*) Roofing slates used in districts having polluted atmospheres should generally be free from carbonates; where experience with a particular variety of slate is not available, the slate may be tested in the laboratory for its resistance to decay.

Clay Bricks and Tiles

Clay bricks, tiles and ceramic building materials in general are usually very durable. Frost, crystallisation of salts, and abrasions are, however, responsible for occasional failures.

(*a*) Decay arising from frost action in general only occurs in circumstances where the bricks are exposed to frost when saturated, or nearly saturated, with water. Bricks exposed in the face of a wall which is partially protected by overhanging eaves and provided with proper damp-proof courses are rarely damaged by frost unless they are of very poor quality. Decay is more often met in parapets, especially when brick-on-edge coping is used, and in retaining walls and free-standing walls, since the brickwork is more likely to become saturated with water. In these situations, therefore, only bricks known by experience to possess high frost resistance should be employed. Further information regarding the quality of bricks suitable for different exposure conditions is given in Code 121.101, "Brickwork."

Roofing tiles are nearly always subject to severe exposure, and only tiles of high frost resistance should be used.

Soluble Salts

(*b*) Soluble salts (mainly calcium, magnesium, sodium, and potassium sulphates) which occur in most clay bricks do not as a rule have any serious effects upon the bricks themselves other than causing an unsightly efflorescence. Occasionally, however, crystallisation of salts may cause disintegration of brick surfaces and/or spalling of plaster or renderings. The most serious failures are those caused by magnesium sulphate. Many clays when burnt never give products containing significant amounts of magnesium sulphate; in those which do, the amount is apt to vary widely so that failures are sporadic. This makes avoidance of unsuitable bricks by analysis of samples somewhat uncertain, and it is advisable, therefore, when using an unfamiliar brick, to enquire into

its reputation in the neighbourhood of the work, where the local architects, builders and bricklayers are likely to know of any such dangers if they exist. The use of dense cement-mortars, which, for a variety of reasons, is undesirable for most types of work, tends to increase efflorescence of the salts on the bricks.

Calcium sulphate, which is only slightly soluble in water, nearly always forms the bulk of the soluble salts present in bricks. By itself, it very seldom causes efflorescence or disintegration through crystallisation, but, in brickwork which remains damp, it is capable of causing sulphate attack on cement-mortar or concrete. (Cf. clause 4 (e) above.).

(*c*) In positions where abrasion may occur, bricks which have a sufficient resistance to abrasion should be used.

(*d*) In sewers or other conditions exposed to industrial wastes or spillage it is desirable to use hard bricks of low porosity to avoid any risk of chemical attack.

The classification of sulphate soil conditions in so far as they affect concrete and some recommended precautionary measures are given in Table 1.

BRITISH CERAMIC SOCIETY

THE Refractory Materials Section of the Society was held recently in Sheffield and the chairman, Mr. W. Boyd Mitchell, O.B.E., welcomed quite a number of overseas visitors among whom were: Mr. John D. Sullivan, Mr. H. Kraner and Dr. J. B. Austin (U.S.A.); Mlle. L. Halm, Mme. P. Lapoujade and Professor Y. Letort (France); Messrs. A. F. J. Kaiser, K. Kooij and G. van Gijn (Holland); Mr. L. S. Roa (India); Dr. F. Savioli (Italy); Dr. M. Jacobs (South Africa), Dr. J. M. B. Aristequi (Spain).

At the meeting, the Scroll of the Fellowship of the American Ceramic Society was presented to Dr. A. T. Green, hon. general secretary of the British Ceramic Society and Director of the British Ceramic Research Association. Papers were presented on "Low Alumina Silica Bricks for Open-Hearth Furnace Roofs" and "Trials of Refractories in Steel Plants."

Members also visited the new Dolomite Works of the Steetly Co. at Cadeby and the firebrick works of J. and J. Dyson Ltd., as well as the Templeborough Steel Works of Steel, Peech and Tozer. At Cadeby visitors saw an exhibition of blasting in the quarry. Dyson's firebrick works mostly manufacture ladle sleeves, stoppers and nozzles as well as runner bricks for the steel industry. Another product is firebricks for the domestic hearth.

In the evening there was an organised coach drive through the Dukeries.

The autumn meeting of the Refractory Materials Section will be held in London and the new chairman, Dr. J. H. Chesters, will preside. Dr. G. R. Rigby was re-elected as hon. section secretary.

Dr. A. T. Green, who recently received the Scroll of the Fellowship of the American Ceramic Society

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